

Arizona Department of Transportation

ARIZONA TRANSPORTATION Research Center



FY 2008 RESEARCH PROGRAM



Estimated State Planning & Research Program

Part II – Research

Arizona Department of Transportation
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In cooperation with:

U.S. Department of Transportation
Federal Highway Administration

SPR-PL-1(173)
Fiscal Year 2008
(July 1, 2007 – June 30, 2008)

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Glossary of Acronyms

AASHTO	American Association Of State Highway & Transportation Officials
AC	Asphaltic Concrete
ACFC	Asphalt Concrete Friction Course
ACMS	Advanced Construction and Maintenance Systems
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
AHRRRC	Arizona Hospitality Research and Resource Center
AHS	Automated Highway Systems
ALISS	Accident Location Identification Surveillance System
APL	Approved Products List
AR-AC	Asphalt-Rubber Asphalt Concrete
AR-ACFC	Asphalt-Rubber/Asphalt-Concrete Friction Course
ARS	Arizona Revised Statutes
ASU	Arizona State University
ATC	Automatic Traffic Counter
ATIS	Advanced Traveler Information System
ATRC	Arizona Transportation Research Center
AVL	Automatic Vehicle Location: GPS-enabled technologies
BYU	Brigham Young University
Caltrans	California Department of Transportation
CCTV	Closed-Circuit TV
CIE	Commission Internationale de L'Eclairage
CRM	Crumb Rubber Modifier
CVISN	Commercial Vehicle Information Systems Network
DOT	Department Of Transportation
DPS	Department of Public Safety
ENTERPRISE	Evaluation of New Technologies for Roads Program Initiatives in Safety and Efficiency
FHWA	Federal Highway Administration
FM	Frequency modulation
FWD	Falling Weight Deflectometer
FY	Fiscal Year
G4	A type of guard rail
GCNP	Grand Canyon National Park
GIS	Geographic Information System
GOHS	Governor's Office of Highway Safety
GPS	General Pavement Studies
GPS	Global Positioning Satellite
GTSAC	Governor's Traffic Safety Advisory Council
HAR	Highway Advisory Radio
HCRS	Highway Condition Reporting System
HMA	Hot Mix Asphalt

HMAC	Hot Mix Asphaltic Concrete
HOV	High Occupancy Vehicle
HPC	High Performance Concrete
HPS	High-Pressure Sodium
IDMS	Integrated Document Management System
IES	Illuminating Engineering Society
ISPMMS	Integrated Sign and Pavement Marking Management System
ITD	Intermodal Transportation Division
ITEP	ITS, Traffic & Safety, Environment, Planning
ITG	Information Technology Group
ITS	Intelligent Transportation System
IV	Intelligent Vehicle
JLBC	Joint Legislative Budget Committee
JPA	Joint Project Agreement
LOS	Level Of Service
LPS	Low-Pressure Sodium
LTAP	Local Technical Assistance Program
LTPP	Long Term Pavement Performance
MAG	Maricopa Association of Governments
MH	Metal Halide
MOE	Measures Of Effectiveness
MP	Milepost
MSE	Mechanically-Stabilized Earth
MSM	Materials, Structures, and Maintenance
MUTCD	Manual of Uniform Traffic Control Devices
MVD	Motor Vehicle Division
N/A	Not Applicable
NAU	Northern Arizona University
NCAT	National Center for Asphalt Technology
NCHRP	National Cooperative Highway Research Program
NOAA	National Oceanographic and Atmospheric Administration
NTCIP	National Transportation Communications for Intelligent Transportation Systems Protocol
NTPEP	National Transportation Product Evaluation Program
OGFC	Open-Graded Friction Courses
P3	Pollution Prevention Plan
PC	Personal Computer
PIJ	Project Investment Justification
PM10	Particulate Matter less than 10 microns in diameter
PM2.5	Particulate Matter less than 2.5 microns in diameter
PMS	Pavement Management System
PRIDE	Product Resource Investment Deployment And Evaluation
R&D	Research & Development
R/W	Right-Of-Way
RFP	Request For Proposal
RV	Recreational Vehicle

RWIS	Roadway Weather Information System
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SGC	Sand-Gravel-Cobbles
SHRP	Strategic Highway Research Program
SNAFU	Situation Normal, Activity Focus Unchanged
SPR	State Planning & Research
SPS	Specific Pavement Studies
SPUI	Single-Point Urban Interchange
SR	State Route
TAC	Technical Advisory Committee
TBD	To be determined
TEA-21	Transportation Equity Act for the 21 st Century
TI	Traffic Interchange
TNM	Traffic Noise Model
TPD	Transportation Planning Division
TRB	Transportation Research Board
TTI	Texas Transportation Institute
UDOT	Utah Department of Transportation
VMS	Variable Message Sign
VOC	Volatile Organic Compound
VSL	Variable Speed Limit
WASHTO	Western Association of State Highway & Transportation Officials
WIM	Weigh-In-Motion
WSDOT	Washington State Department of Transportation

Overview

The Arizona Transportation Research Center (ATRC) directs the Arizona Department of Transportation (ADOT) research program.

ATRC MISSION — The ATRC mission is to pursue and share knowledge in transportation systems and programs.

ATRC VISION — ATRC sets the national standard of excellence for transportation research, product evaluation and library services.

The research program encompasses seven research emphasis areas:

- Environment
- Intelligent Transportation Systems
- Maintenance
- Materials & Construction
- Planning & Administration
- Structures
- Traffic & Safety

The research program also includes the ADOT Product Resource Investment Deployment and Evaluation (PRIDE) program. The review and acceptance of new products for possible use by ADOT is coordinated through the PRIDE program. The Approved Products List (APL) is also maintained under the PRIDE program.

ATRC houses and operates the main ADOT library. The library is maintained by a full time librarian. The ATRC Library is open to ADOT employees, transportation faculty in Arizona universities, and Arizona local and county transportation staff.

The library catalogue is available on the Internet. The library collection currently includes nearly 30,000 entries, including over 60 journal and magazine subscriptions.

This ATRC annual report provides descriptions and progress updates for new and ongoing projects in the Fiscal Year (FY) 2008 *Estimated State Planning & Research (SPR) Program, Part II*. A total of 78 research projects and 12 research support programs are included in this year's program: The program includes 13 new research projects as well as funds budgeted for the small budget program (SPR-127), Transportation Research Board (TRB) dues (SPR-111), and the National Cooperative Highway Research Program (NCHRP) contribution (SPR-125). Sixteen project reports were published during FY 2007. These are listed in the Table 1.

TABLE 1
Fiscal Year 2007 Completed Research Projects

ID #	Title	Project Manager
SPR-371	<i>Maintenance Cost Effectiveness Study</i>	Harris
SPR-460	<i>Evaluation of Cold In-Place Recycle Methods</i>	Dimitroplos
SPR-510	<i>Performance of Various Types of Bridge Deck Joints</i>	Dimitroplos
SPR-569	<i>Transportation Communications Interoperability Phase 2-Resource Evaluation</i>	Owen
SPR-572	<i>Evaluation of Benefits and Opportunities for Innovative Noise Barrier Designs</i>	Kombe
SPR-576	<i>US-93 Big Horn Sheep Study</i>	Kombe
SPR-578	<i>Dyed Diesel Education and Enforcement</i>	Semmens
SPR-579	<i>Making a Good First Impression: Improving PreDesign and Environmental Public Information</i>	Semmens
SPR-582	<i>Multimodal Optimization of Urban Freeway Corridors</i>	Semmens
SPR-585	<i>Snowplow Simulator Training Evaluation</i>	Owen
AZ-594	<i>Flat-Tailed Horned Lizard Highway Crossing Study</i>	Kombe
SPR-595	<i>Real-time Adaptive Ramp Metering: Phase I - Simulation & Proof of Concept</i>	Owen
SPR-620	<i>Developing a Stabilized Public Transportation Revenue Source</i>	Semmens
SPR-621	<i>High Density Polyethylene Pipe Fill Height Table</i>	Dimitroplos
SPR-622	<i>Price Trends for Major Roadway Inputs</i>	Semmens
TRQS-03	<i>Arizona I-19 WiFi Corridor: Concept Demonstration of Probe Vehicle Tracking</i>	Owen

SPR-541, *Strategies and Retrofit Schemes for Concrete Bridge Decks in Arizona* was cancelled at the request of the Technical Advisory Committee.

SPR-559, *Comprehensive Automated Driver's License Testing System: Visual Acuity* phase 2 was canceled at the request of the MVD project sponsor.

SPR-607, *Analysis of and Recommendations for Alleviating Roadway Surface Damage Caused by Snowplow Activity* was cancelled as the objectives of this project will be addressed under project SPR-617 *Effects of Snowplow and Deicing Chemicals on Rubberized Asphalt Pavement* per the request of the Technical Advisory Committee.

SPR-611, *Combining Statistical and Judgmental (Descriptive) Information for Accident Pattern Analysis* was cancelled at the request of the Technical Advisory Committee.

SPR-616, *Development of a Regional Safety Forecasting Tool* was cancelled at the request of the Technical Advisory Committee.

Further information on these completed projects may be obtained from the project managers. Copies of the completed reports may be obtained from the ATRC Librarian. Telephone numbers and e-mail addresses for ATRC staff are shown in Table 2. Reports are also available on the Internet at: <http://www.azdot.gov/TPD/ATRC/publications/index.asp>

TABLE 2
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Departmental Oversight of ATRC

The ADOT Core Team provides broad policy guidance to the research program. Its responsibilities include assuring that the research program is consistent with the ADOT Strategic Plan. When appropriate, the Core Team may also direct the implementation of research results.

The ADOT Research Council oversees the research effort. Responsibilities include advising ATRC, setting research priorities, and approving funding for studies.

Core Team and Research Council members are shown in the following tables.

Core Team

Name	Group
John Bogert	Chief of Staff
Matt Burdick	Director, Communication and Community Partnerships
Dale Buskirk	Director, Transportation Planning Division
Barclay Dick	Director, Aeronautics Division
Jim Dickey	Director, Public Transportation Division
Sam Elters	State Engineer
Win Holden	Publisher, Arizona Highways
Gail Lewis	Communication and Community Partnerships
John McGee	Chief Financial Officer
Victor Mendez	Director
Karen Mills	Special Projects
Stacey Stanton	Director, Motor Vehicle Division
Richard Travis	Deputy Director
Melissa Wynn	Budget & Strategic Planning

Research Council

Name	Group
Julio Alvarado	Construction Group
Matthew Burdick	Director, Communication & Community Partnerships
Dale Buskirk	Director, Transportation Planning Division
John Carlson	Motor Vehicle Division
Frank Darmiento – chairman	Transportation Research Center
Jim Delton	State Materials Engineer
Jim Dickey	Director, Public Transportation Division
Doug Forstie	Deputy State Engineer – Operations
Lonnie Hendrix	State Maintenance Engineer
Karen King	Federal Highway Administration
Mike Manthey	State Traffic Engineer
Sam Maroufkhani	Deputy State Engineer – Development
Jean Nehme	Bridge Group
Scott Nodes	Transportation Technology Group
Rick Powers	Globe District Engineer
Floyd Roehrich, Jr.	Valley Project Management
Suzan Tasvibi-Tanha	Information Technology Group
Mary Viparina	Assistant State Engineer – Roadway
Todd Williams	Director, Office of Environmental Services
Tim Wolfe	Phoenix Maintenance District Engineer

Financial and statistical data are presented in the *SPR Program Budgets* and *Program Statistics* sections. The amount of new funding for FY 2007 is estimated at approximately \$2,851,772. As of June 30, 2007, a total of about \$5,231,511 is available in funds carried forward from prior programs.

The *Implementation* section briefly highlights ADOT actions to implement research results. Summaries of current as well as proposed new SPR projects are presented in for each of the seven research emphasis areas, grouped by emphasis area. Information regarding other types of projects may be found in the *Research Support Programs* and *Pooled Fund Program* sections, respectively.

Also included in this Report is the *Publications Catalog for the Arizona Transportation Research Center*, which lists all of the currently available research reports published by ATRC.

Budgets

The following tables summarize the financial status of each of the ongoing ATRC projects. Each project is identified by number and title. Funds carried over from previous years and funds to be provided by the fiscal year 2008 allocation are estimated for each project.

Each project is classified in one of the following categories: E: Environment, I: Intelligent Transportation Systems (ITS), M: Maintenance, MC: Materials and Construction, P: Planning and Administration, R: Research Support, ST: Structures, and T: Traffic and Safety.

State Planning & Research Funded Program

ID No.	Project Name	Area ¹	Carry Over ²	FY 2008 Funds
SPR-110	<i>ATRC Library Resources</i>	R	68,295	30,000
SPR-111	<i>Transportation Research Board Correlation/AASHTO³</i>	R	3,620	140,000
SPR-112	<i>Administration of Research</i>	R	116,689	30,000
SPR-113	<i>Support Staff Salaries</i>	R	100,068	275,000
SPR-114	<i>Technical Editing</i>	R	37,350	15,000
SPR-116	<i>PRIDE</i>	R	188,180	50,000
SPR-117	<i>Local Technology Assistance Program</i>	R	55,716	68,000
SPR-118	<i>Transportation Research Quick Study Program</i>	R	20,000	20,000
SPR-120	<i>Pooled Fund Studies^{3, 4}</i>	R	- 0 -	50,000
SPR-124	<i>Research Traffic Data Collection</i>	R	197,764	100,000
SPR-125	<i>NCHRP³</i>	R	- 0 -	740,000
SPR-127	<i>Small Budget Studies</i>	R	76,000	200,000
SPR-396	<i>LTPP and Other Test Section Management and Evaluation</i>	MC	48,000	150,000
SPR-402	<i>Development of Performance Related Specifications for Asphalt Pavements</i>	MC	8,646	- 0 -
SPR-473	<i>Arizona Intelligent Vehicle Systems Evaluation</i>	I	3,884	- 0 -
SPR-493	<i>Bridge Foundation Design Parameters, SGC Bearing Materials</i>	ST	34,212	- 0 -
SPR-500	<i>Aggregate Sources in Northern Arizona</i>	M	240,885	- 0 -
SPR-524	<i>Mix Design and Product Specifications for Asphalt Rubber Concrete</i>	MC	22,860	- 0 -
SPR-534	<i>Developing an Electronic "Signature" Process for ADOT</i>	P	14,029	- 0 -
SPR-535	<i>Safety Information Exchange System for the Nogales Port of Entry</i>	P	142,400	- 0 -
SPR-536	<i>Improved Snow Plow Headlight Visibility and Reduced Driver Fatigue</i>	M	47,600	- 0 -
SPR-538	<i>High Performance Concrete for Bridge Structures in Arizona</i>	ST	79,000	- 0 -
SPR-540	<i>Wildlife/Vehicle Collision Mitigation</i>	E	18,085	- 0 -

ID No.	Project Name	Area¹	Carry Over²	FY 2008 Funds
SPR-544	<i>Service Strategies to Reduce Customer Time in MVD Field Offices</i>	P	11,400	- 0 -
SPR-547	<i>Arizona Statewide Safety Project Analysis Model</i>	P	11,291	- 0 -
SPR-571	<i>Options for Reducing ADOT's Legal Liability Costs</i>	P	40,000	- 0 -
SPR-574	<i>Use of NDT Equipment for Construction Quality Control of Hot Mix Asphalt Pavements</i>	MC	2,424	- 0 -
SPR-575	<i>Concrete Aggregate Durability Study</i>	MC	19,994	- 0 -
SPR-577	<i>Pavement Noise Study⁵</i>	MC	- 0 -	97,000
SPR-583	<i>Open Source Software Study</i>	P	13,772	- 0 -
SPR-584	<i>Survey of Traffic Noise Reduction Products, Materials and Technology</i>	E	5,104	- 0 -
SPR-586	<i>Investigation of Earth Pressure on Concrete Cantilever Retaining Wall for Variable Quality Backfill</i>	ST	150,000	- 0 -
SPR-587	<i>Evaluation of Salvage and Replanted Native Plants on ADOT Projects</i>	E	75,000	- 0 -
SPR-588	<i>A Study of the Effectiveness of Bighorn Sheep Underpasses on State Route 68</i>	E	60,728	- 0 -
SPR-589	<i>Determination of 404 Permit Requirements and Habitat Restoration Requirements</i>	E	125,000	- 0 -
SPR-590	<i>Performance Related Pay Factors for Asphalt Concrete</i>	MC	- 0 -	- 0 -
SPR-591	<i>High Crash Risk Unsignalized Intersections</i>	T	23,330	- 0 -
SPR-592	<i>Building Tribal Traffic Safety Capacity</i>	T	65,000	- 0 -
SPR-593	<i>Development and Implementation of a Regional Safety Management Database</i>	T	5,830	- 0 -
SPR-597	<i>Highway Safety Incentive Report</i>	T	41	- 0 -
SPR-598	<i>Analysis of Bicycle Lanes (BL) Versus Wide Curb Lanes (WCL)</i>	P	12,300	- 0 -
SPR-600	<i>Evaluating the Effectiveness of Microbe Application to Petroleum Spills at Crash Sites</i>	E	10,500	- 0 -
SPR-601	<i>Cost Evaluation of Cross-Border Truck Emissions Testing using Heavy Duty Remote Sensing (HDRS) Equipment</i>	E	7,361	- 0 -
SPR-602	<i>Sampling and Analyses of Storm Water Runoff</i>	E	39,200	- 0 -
SPR-603	<i>Continued Evaluation of Measures to Minimize Wildlife-Vehicle Collisions & Maintain Wildlife</i>	E	49,568	- 0 -
SPR-604	<i>Real-Time Adaptive Ramp Metering: Phase 2–Implementation and Enhancement</i>	I	194,236	- 0 -
SPR-605	<i>Investigations of Environmental Effects on Freeway Acoustics</i>	MC	25,205	- 0 -
SPR-606	<i>Implementation Of The Mechanistic-Empirical (M-E) Design Guide For Arizona</i>	MC	350,000	- 0 -
SPR-608	<i>Development of Rational Pay Factors Based on Concrete Compressive Strength Data</i>	MC	- 0 -	- 0 -

ID No.	Project Name	Area¹	Carry Over²	FY 2008 Funds
SPR-609	<i>Driver Education for Safety in Adverse Driving Conditions</i>	P	28,601	- 0 -
SPR-610	<i>Implementing a Statewide Rideshare Program in Arizona</i>	P	41,004	- 0 -
SPR-612	<i>Evaluate Effectiveness of Cattle Guards and Fencing</i>	M	2,320	- 0 -
SPR-613	<i>Quantifying the Impact of Opening a New Segment of Freeway</i>	P	11,220	- 0 -
SPR-614	<i>Origins and Destination Study for Older Persons</i>	P	11,355	- 0 -
SPR-615	<i>ITS Concepts for Rural Corridor Operations</i>	I	40,416	- 0 -
SPR-617	<i>Evaluate Effect of De-icing Chemicals on Rubberized Pavements</i>	M	116,740	- 0 -
SPR-618	<i>Land Use and Traffic Congestion</i>	P	90,100	- 0 -
SPR-619	<i>Antelope Movements North of Interstate 40 in Arizona</i>	E	144,344	- 0 -
SPR-623	<i>Increasing Vehicle Registration Compliance and Revenue through Proactive Identification</i>	P	15,000	- 0 -
SPR-624	<i>Hazardous Materials Transportation in Arizona</i>	E	53,000	- 0 -
SPR-625	<i>Safety Enhancements for Median Crossovers</i>	T	30,000	- 0 -
SPR-626	<i>State Route 64 Wildlife Accident Reduction Study Monitoring</i>	E	195,600	- 0 -
SPR-627	<i>State-of-the-Art Evaluation of Traffic Detection and Monitoring Systems</i>	I	173,280	- 0 -
SPR-628	<i>Evaluation of Maintenance Strategies for ADOT</i>	M	100,000	- 0 -
SPR-629	<i>Analysis of Capacity and Operations after Retrofit Improvements of Happy Valley and I-17 Roundabout Traffic Interchange</i>	T	72,022	- 0 -
SPR-630	<i>Critical Review of ADOT's Hot Mix Asphalt Specifications</i>	MC	69,000	- 0 -
SPR-631	<i>Evaluate Warm Mix Technology for use in Asphalt Rubber – Asphaltic Concrete Friction Courses (AR-ACFC)</i>	MC	150,000	- 0 -
SPR-632	<i>Development of Materials for Repairing AR-ACFC Surfaces</i>	M	100,000	- 0 -
SPR-633	<i>Economical Concrete Mix Designs Utilizing Blended Cements, Performance Based Specifications, and Rational Pay Factors</i>	MC	120,000	- 0 -
SPR-634	<i>A Platform for Evaluating Emergency Evacuation Strategies</i>	I	94,436	- 0 -
SPR-635	<i>Improved Efficiency Through Driving Simulator Training</i>	I	50,000	- 0 -
SPR-636	<i>"Heat Island" Effect of Pavements</i>	P	50,000	- 0 -
SPR-637	<i>Cost/Benefit Analysis of Electronic License Plates</i>	P	14,250	- 0 -
SPR-638	<i>Research for Mobile Source Air Toxics (MSATs) in Maricopa County</i>	E	15,000	- 0 -
SPR-639	<i>Effectiveness of Various Pre-Emergent Herbicides</i>	P	10,500	- 0 -
SPR-640	<i>Cost-Effectiveness of Mobile Enforcement</i>	P	15,000	- 0 -

ID No.	Project Name	Area ¹	Carry Over ²	FY 2008 Funds
SPR-641	<i>Oversized Vehicle Study</i>	P	15,000	- 0 -
SPR-642	<i>Delivery of a Technical Curriculum Using Learner-Based Instruction and Communication Modalities in a Distributed Environment</i>	P	24,000	- 0 -
SPR-643	<i>Evaluation of Yellow Left-Turn Arrow Phasing and Flash Options</i>	I	24,500	- 0 -
SPR-645	<i>Automatic Vehicle Location (AVL) and Maintenance Work Effort Tracking⁶</i>	I	125,000	- 0 -
SPR-646	<i>AASHTOWare Turborelocation Software Development</i>	P	- 0 -	100,000
SPR-647	<i>Elk Movements Associated with a High-Traffic Highway: Interstate-17</i>	E	- 0 -	250,000
SPR-648	<i>Crash Related Education, Enforcement, and Engineering Factors</i>	T	- 0 -	120,000
SPR-649	<i>Safety Issues Due to Unforeseen Stoppage of High Speed Mainline Traffic</i>	M	- 0 -	60,000
SPR-650	<i>Predicting Desert Tortoise (<i>Gopherus agassizii</i>) Habitat and Identifying Movement Patterns within the Proposed Highway 95 Realignment</i>	E	- 0 -	346,000
SPR-651	<i>Using Substantive Instead of Nominal Safety During ADOT Project Development</i>	T	- 0 -	50,000
SPR-652	<i>Countermeasures to Reduce Big-Rig Crashes</i>	T	- 0 -	100,000
SPR-653	<i>Arizona VII Initiative: Proof of Concept/Operational Testing⁶</i>	I	200,000	- 0 -
SPR-654	<i>Options & Impacts of Measures to Reduce Single-Occupant Vehicle (SOV) Traffic</i>	P	- 0 -	50,000
SPR-655	<i>Identifying Customer-Focused Performance Measures⁷</i>	P	100,000	- 0 -
SPR-999	Contingency	R	579,195	220,824
	<i>Completed or Closed Projects⁸</i>	--	250,159	- 0 -
	TOTALS		5,951,609	3,261,824

Table Notes:

¹ Abbreviations under Area refer to program areas – E: Environment, I: Intelligent Transportation Systems (ITS), M: Maintenance, MC: Materials and Construction, P: Planning and Administration, R: Research Support, ST: Structures, T: Traffic and Safety

² Includes amounts newly transferred into projects from earlier program years' contingency funds and non-SPR funding. All carryover amounts for these and other projects are as of 06/30/2007.

³ Funded with 100% Federal funds.

⁴ If any new pooled fund projects are approved, up to \$50,000 will be allocated from this account. Previously approved funding includes: Solicitation 1124, *Mobile Source Air Toxics (MSAT) From Major Highways*—\$35,000 (FY2007) and \$35,000 (FY2008); Solicitation 1150, *Interstate Technical Group on Abandoned Underground Mines (ITGAUM) Support*, \$5,000 (FY2007); Pooled Fund Study SPR-3(020), *IVHS Study (ENTERPRISE)*—\$30,000 (FY2007), \$30,000 (FY2008), \$30,000 (FY2009); TPF-5(145), *Western Maintenance Partnership*—\$5,000 (FY2006), \$5,000 (FY2007), \$5,000 (FY2008); TPF-5(166), *Application of Three-Dimensional Laser*

Scanning for the Identification, Evaluation, and Management of Unstable Highway Slopes—\$15,000 (FY2007), \$15,000 (FY2008)

⁵ Project SPR-577 was funded in FY2004 with \$364,000 in SPR Planning funds and \$99,000 in FY2005 Research Funds. Additional Research funds planned are as follows: FY2008 - \$97,000; FY2010 - \$97,000.

⁶ Projects SPR-645 and SPR-653 were originally approved as part of the FY2008 program. However, timing dictated that these projects begin as soon as possible. Funding was available in the FY2006 program for these projects. Therefore, they have been added to the FY2006 program rather than the FY2008 program.

⁷ Project SPR-655 was requested by ADOT executive management. It is funded from the FY2006 program budget.

⁸ Funds from completed or closed projects (includes SPR-439, 459, 491, 495, 496, 510, 518, 520, 537, 569, 578, 579, 582, 585, 594, 595, 608, 620, 621). These funds will be transferred to other research activities.

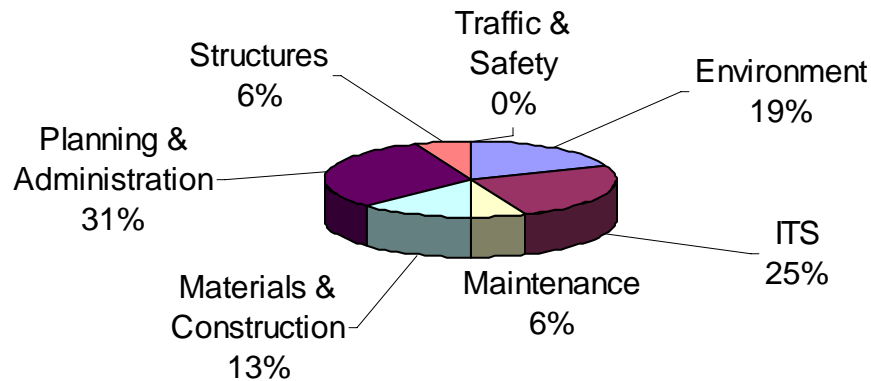
Statistics

There were 16 project completions accounting for a budget of \$ 1,169,845 during FY 2007 (July 1, 2006 through June 30, 2007). The distribution of these projects by emphasis area is shown below.

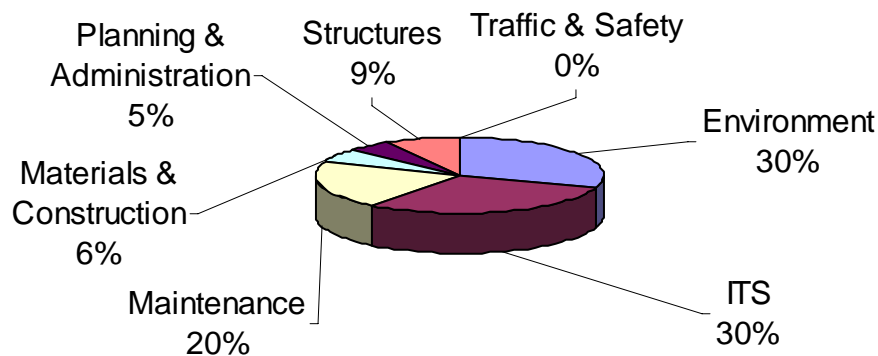
FY 2007 Project Completion Summary

Category	No. of Projects	Funds Spent
Environment	3	\$ 353,400
ITS	4	\$ 352,500
Maintenance	1	\$ 238,945
Materials & Construction	2	\$ 70,000
Planning & Administration	5	\$ 55,000
Structures	1	\$ 100,000
Traffic & Safety	0	
Totals	16	\$ 1,169,845

Project Completion Distribution

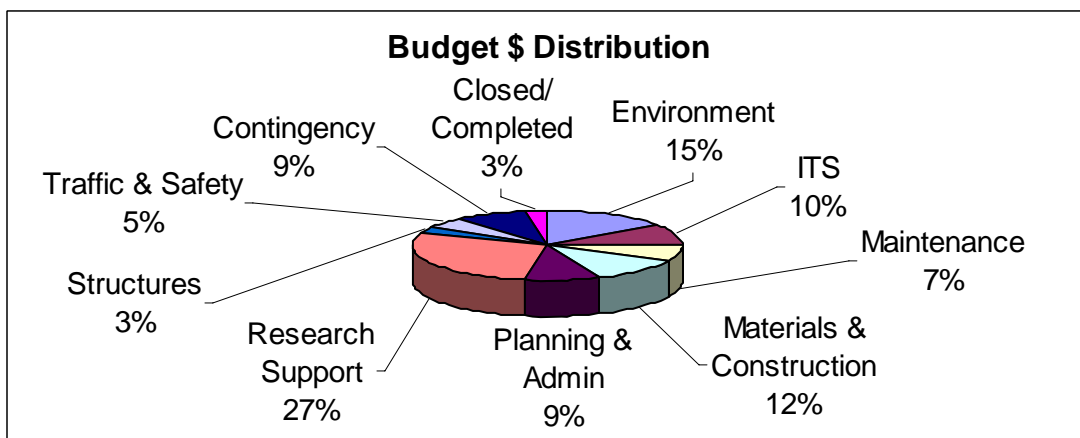
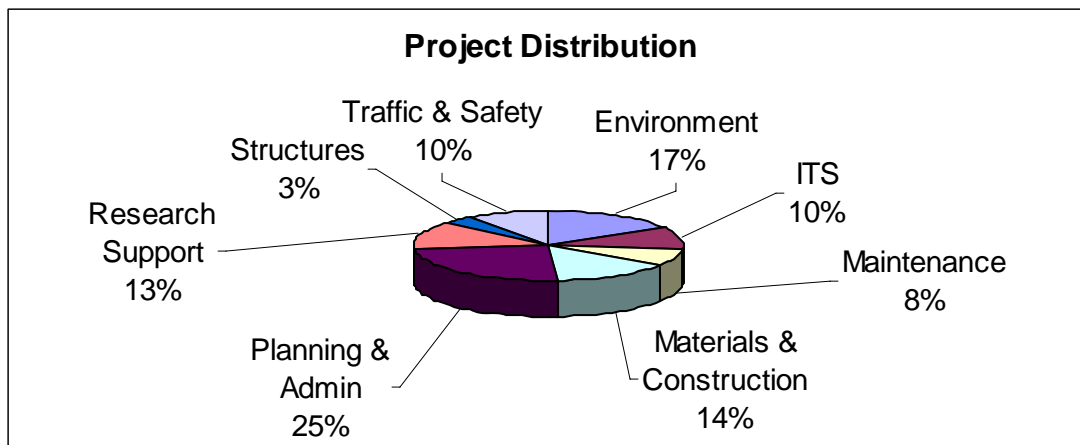


Project Completion Budget Distribution



There are 90 project tracking accounts in the current program accounting for a budget of \$9,213,433. The distribution of these projects by category is shown below.

Category	Number of Projects	Budget
Environment	15	\$ 1,396,300
ITS	9	\$ 905,752
Maintenance	7	\$ 667,545
Materials & Construction	13	\$ 1,097,870
Planning & Administration	22	\$ 821,222
Structures	12	\$ 2,581,682
Traffic & Safety	3	\$ 263,212
Research Support	9	\$ 466,223
Contingency	0	\$ 800,019
Closed/Completed Projects	0	\$ 250,159
Totals	90	\$ 9,213,433



Implementation

The following list highlights implementation activities undertaken during fiscal year 2007:

SPR	Project Name and Description of Implementation
473	<p><i>Arizona Intelligent Vehicle Research:</i> This long-term project previously evaluated primary collision warning radar and night vision systems in three ADOT maintenance districts, but deployment recommendations that require district funding have not been successful. All seven test units remain in service.</p> <p>During 2005-06, ATRC conducted a field evaluation of radar backing-warning systems. The evaluation showed considerable advantages for these radars, as compared to rear-view cameras on several other vehicles. ATRC presented the findings to senior maintenance managers in August 2006, and several districts identified specific vehicles to be equipped with blind-spot radar. In early 2007, Equipment Services set up a parts contract so that ADOT field forces could procure these low-cost units on their own to meet local needs. As of mid-year, more than 20 rear-warning radars have been acquired across the state.</p>
486	<p><i>Highway Facilities for an Aging Arizona Population:</i> The following major design enhancements were made to a segment of US-60 in Sun City: Removed right turn channelization from all four corners, tightened turn radii, increased left-turn storage length, installed larger street name signing, installed larger advance street name signing, used ClearView font on signs, installed larger traffic signal ball indicators. Preliminary draft results indicate favorable resident responses: 79% found the intersection easier to use, 99% found the visibility of signals to be improved, 95% found the turn lanes to be improved, and 94% found street signs to be improved. A before-and-after crash evaluation is due in early calendar 2008.</p>
530	<p><i>Critical Factors in the Development of Transit Systems in Rural Arizona--</i>PTD has made progress in implementing the recommendations of this research (1) PTD has shifted some planning responsibilities in order to assume more in-house capacity. One remaining position is to be filled, and another staff member has assumed part time responsibility for needs assessments. (2) PTD again requested General fund contributions to support AZRides in the 08 budget; it has also commissioned, through ATRC, a study of likely revenue sources that could supplement current funding that will be part of a recommendation in the current Executive Order 2007-2. (3) PTD continues the AzRides program with full time staff now. Coordination planning is underway consolidating FTA 5310, 5316, and 5317 programs.</p>

SPR	Project Name and Description of Implementation
540	<p><i>Evaluation of Wildlife Vehicle Collision Mitigation – SR260:</i></p> <p>This project is in final review for publication (08/2007). A close working relationship between the Arizona Game & Fish Department research team and ADOT project engineers in the (Payson) area allowed for many aspects of the preliminary findings during the study period to be evaluated and incorporated in subsequent project plans and designs by ADOT. Upon publication of the final report, efforts will be increased to continue consultations between all interested parties regarding the best ways to take full advantage of project findings and recommendations.</p>
569	<p><i>Transportation Communications Interoperability Phase 2- Resource Evaluation:</i></p> <p>The <i>SPR-561 Needs Assessment</i> project proposed improvements in ADOT’s radio communications with partner agencies, and internally. SPR-569 focused on two methods of direct radio contact between ADOT and the state police, which operate on different frequencies. Two field tests were done; one upgraded highway patrol and ADOT dispatcher consoles, to allow “crosspatches” between field vehicles. This was judged successful for incident management on larger-scale events, and it is now an approved option, as is a focused training program to ensure its successful use. The second test was to place an extra ADOT-style radio in 65 rural highway patrol cars, which was judged the <i>most successful</i>, by field personnel. However, the cost to add 600+ more radios was not viable for the state police agency, and it was deferred.</p>
570	<p><i>Rural ITS Progress Study - Arizona 2004:</i> Implementation of project 570 results was an ongoing process of wider deployments and revised practices; the study results also supported requests for further funding in several key operations areas. The most current implementation was the approval of a second phase, “state-of-the-practice” study, SPR 615, to identify new concepts and best practices for ADOT to address remaining gaps in rural ITS deployments. This new state-of-the-practice project began in July 2006 and will be completed in Fall 2007.</p>
572	<p><i>Evaluation of Benefits and Opportunities for Innovative Noise Barrier Designs –</i></p> <p>Typically ADOT will consider unconventional noise mitigation structures in special situations. When such needs arise, the potential exists to employ one or more of the barrier designs recommended in this study. The Environmental Planning Group, Air and Noise team has reviewed the study recommendations with a view to determining the circumstances and extent of possible consideration on ADOT projects in the future.</p>

SPR	Project Name and Description of Implementation
576	<p><i>US93 Bighorn Sheep Study: Distribution and Trans-Highway Movements of Desert Bighorn Sheep in NW Arizona</i></p> <p>Published January 2007. The recommendations made in this report will be discussed between ADOT, Game and Fish, and other stakeholders to review the findings and report recommendations. This will provide an opportunity to initiate steps towards future implementation of those items that are deemed feasible by the department.</p>
579	<p><i>Making a Good First Impression: Improving Predesign and Environmental Public Information</i>—The purpose of this study was to examine the current public information and public involvement structures and functions as well as opportunities for improving these structures and functions and recommend potential improvements. Eight recommendations were made and are currently under review by ADOT’s Communications and Community Partnerships section.</p>
582	<p><i>Multimodal Optimization of Urban Freeway Corridors</i>—The purpose of this study was to compare forms of multi-modal travel by means of a case study of a freeway corridor in the Phoenix metropolitan region. Five options were compared: (1) high-occupancy/toll (HOT) lanes, (2) adding a fourth general purpose (GP) lane, (3) HOV lane with non-exclusive bus rapid transit (BRT), (4) exclusive BRT, and (5) light rail transit (LRT). The results, ranked from most cost-effective to least cost-effective, are as follows (Note: the range is due to whether costs are spread over all traffic or only peak-period traffic):</p> <ol style="list-style-type: none"> 1. HOT Lane (\$0.012 to \$0.027 per person-mile) 2. Fourth GP Lane (\$0.019 to \$0.042 per person-mile) 3. HOV (w/BRT) Lane (\$0.026 to \$0.057 per person-mile) (existing condition) 4. Exclusive BRT Lane (\$0.066 to \$0.147 per person-mile) 5. Light Rail Transit (\$0.161 to \$0.358 per person-mile) <p>While no specific implementation action has yet taken place, the study has garnered widespread interest and may yet help guide future decisions on how to make best use of the space available in the right-of-way.</p>

SPR	Project Name and Description of Implementation
585	<p><i>Snowplow Simulator Training Evaluation:</i> This 2004-06 project focused on the Globe District, where ADOT's first simulator training program was established.</p> <p>Based on initial positive reports from field staff and from this project, three more units have been deployed to the Flagstaff, Holbrook and Safford Districts. In 2006, ADOT also created a Working Group of training staff from these districts. Its goals are to maintain a consistent training approach in a core winter curriculum for the new districts that also addresses their local issues, and, to develop new course materials to meet ADOT's broader needs.</p> <p>Due to limited field data from SPR-585, a new project (SPR-635) was initiated for 2006-07 to measure the simulator training effect on fuel efficiency and repair costs for the Globe District fleet. This study will use field data from a full year of fleet operations, as well as fuel economy road tests, to perform a benefit-cost analysis of simulator training. Project 635 will be completed in Fall 2007.</p>
595	<p><i>Real-time Adaptive Ramp Metering: Phase 1 - Simulation & Proof of Concept:</i> This project established two-way communication between ramp metering signal controllers, and the ADOT Traffic Operations Center. It showed that real-time data could effectively support the MILOS metering control software. As a result, the new 604 project has been initiated to field test MILOS, using freeway traffic detector speed data to optimize the ramp metering rates. This project is expected to be completed in mid-2008.</p>
AZ-596	<p><i>Evaluation of Photo Radar for Freeway Enforcement:</i> Direct implementation of this 2005 project was on standby for over a year, pending the outcome of related but independent evaluations by the City of Scottsdale, with a photo-enforcement system that did not meet all of the State's criteria developed in Project 596.</p> <p>A nine-month field trial was conducted on the L-101 freeway in 2006, with mixed results from six fixed camera sites. Based upon <i>preliminary</i> results in January 2007, the Governor's Office mandated that the Arizona Department of Public Safety (DPS) was to take over the Scottsdale corridor sites, set up a valid judicial process, and continue the program, which is being negotiated as of mid-2007. DPS also was tasked to create a mobile photo-speed approach for rural highways.</p>
620	<p><i>Developing a Stabilized Public Transportation Revenue Source--</i> The purpose of this research was to investigate funding mechanisms that might be explored to provide a dedicated revenue source for public transportation within the State of Arizona. Three legislative actions were recommended. ADOT's Public Transportation Division has committed to try to achieve these legislative actions.</p>

SPR	Project Name and Description of Implementation
622	<p><i>Price Trends for Major Roadway Inputs--</i> The objective of this research project was to examine the price fluctuations of the most heavily used construction commodities over both the short and long terms. An index for each of these commodities has been created. The implementation plan for this project is to generate a monthly update of these indices and distribute it to personnel charged with estimating future construction costs for projects and budgeting the highway construction and maintenance programs. Monthly updates are now being published by the ATRC.</p>
TRQS - 02	<p><i>Arizona I-19 Wi-Fi Corridor: Assessment of Opportunities for Probe Data Operations:</i> This study was an evaluation of field conditions and design criteria for the use of wireless internet technology to acquire probe vehicle data. It was focused on an existing 30-mile WiFi corridor, created in southern Arizona as a public safety resource. The report identified options for field tests of the ability to acquire traffic data for rural highway management. A new large-scale pilot project was nominated for FY2007, but was not funded. However, this TRQS-02 report inspired a local technology developer to propose a second Quick Study, which was mobilized and demonstrated in early 2007. The <i>TRQS-03</i> project, titled <i>Concept Demonstration of Probe Vehicle Tracking</i>, successfully showed that meaningful vehicle data could be acquired by prototype sensors and communicated to the WiFi system. Issues with Internet access, however, were a persistent problem.</p>

Environment

Environment – PROJECTS

SPR-540, Evaluation of Measures to Minimize Wildlife Vehicle Collisions and Maintain Wildlife Permeability across Highways (Phase I and Phase II)

Research Agency:	Arizona Game & Fish Dept.	FY Authorization:	2004
Principal Investigator(s):	Mr. Norris Dodd Phase 2	Contract Date:	12/16/2003
Contract Amount:	\$344,000	Original Completion Date:	06/2006
Program Budget:	\$344,000	Estimated Completion Date:	09/30/2007
Expenditures to date:	\$325,915	Is project on schedule?	Yes
Available Amount:	\$18,085	ADVANTAGE Nos.	R054014P, P600013P*
Percent complete through 6/30/07	98%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

* includes SPR Part 1 funds

PROBLEM STATEMENT

Animal/vehicle collisions result in human fatalities, injuries, and extensive property losses every year in Arizona. As the Arizona Department of Transportation (ADOT) upgrades existing rural highways the problem intensifies. Collisions increase with speed and traffic volume. The issue of vehicle/wildlife collisions is becoming more of a concern to citizens and resource managers. These collisions cause millions of dollars of property damage and litigation associated with such collisions is increasing. These concerns are impacting highway construction costs and project schedules as highway designers and scientists look for solutions to the problem. A lack of scientifically collected data on the effectiveness of various mitigation measures compounds the problem especially here in Arizona where no valid studies have been conducted.

ADOT will be implementing a comprehensive package of measures to address wildlife concerns as part of the upgrade of SR260 from Payson to Show Low. These measures will conservatively cost more than 3.5 million dollars. None of these measures have been implemented in Arizona before nor has their effectiveness been evaluated. Since animal/vehicle collision mitigation methods will be used in the future on other highways in Arizona, it is imperative that these methods are evaluated to determine their effectiveness at increasing highway safety and maintaining wildlife permeability.

RESEARCH OBJECTIVES

The objective of this proposed research is to measure the effectiveness of the various highway design features to reduce wildlife/vehicle collisions and maintain habitat connectivity on the state highway 260 corridor.

At a minimum, the following tasks will be accomplished by the researcher:

1. Meet with the Technical Advisory Committee to discuss the scope of work and action plan.

Environment

2. Document and report the incidence of wildlife/vehicle collisions along the entire length of the study area. Analyze and compare the wildlife/vehicle collisions along the test area with the data in the same areas collected since 1987.
3. Monitor the movement of adult elk in three time periods; pre-construction, during construction, and post construction. Analyze the data to determine the degree to which wildlife permeability across the highway is maintained.
4. Monitor the wildlife-proof fencing to determine its effectiveness at limiting wildlife access to the fenced highway.
5. Document the research effort and findings in a final report.

EXPECTED IMPLEMENTATION

This research will provide the required data for the need, design, location, and frequency of underpasses for the conveyance of wildlife under a highway. It will evaluate the effectiveness of various wildlife-proof fence configurations in containing and directing large game animals. The research will evaluate the effectiveness of one-way gates and escape ramps in allowing large game animals to return to the off-highway side should a breach in the fence occur. This research will establish a database that will provide more complete information on the frequency, location, species, and damage related to wildlife/vehicle collisions

STATUS OF THE RESEARCH

The final report for the project (Phases I & II) was submitted for final review in July '07. The technical advisory committee (TAC) had already reviewed the draft report and provided input and comments for the final version of the report. Publication of the report is expected in September/October 2007.

TECHNICAL ADVISORY COMMITTEE (TAC)

Bruce Eilerts	Natural Resources, ADOT
Mike Ross	Tonto National Forest
Doug Brown	AZ Dept. of Administration
Norris Dodd	AZ Game & Fish Dept., Research Leader
Ray Schweinsburg	AZ Game & Fish Dept.
Steve Thomas	Federal Highway Administration
Terry Brennan	Tonto National Forest
Melissa Maiefski	ADOT Environmental & Enhancement Group
Tom Kombe	ADOT Research Project Manager, ATRC
Cindy Eiserman	Risk Management, ADOT

Environment

SPR-584, Survey of Traffic Noise Reduction Products, Materials, and Technologies

Research Agency:	Prophecy Consulting Group	FY Authorization:	2005
Principal Investigator(s):	Violettee (Vi) Brown	Contract Date:	12/27/04
Contract Amount:	\$7,980.00	Original Completion Date:	06/2006
Program Budget:	10,000.00	Estimated Completion Date:	12/31/2007
Expenditures to date:	\$4,896.00	Is project on schedule?	No
Available Amount:	\$5,104.00	ADVANTAGE No.	R058417P
Percent complete Through 6/30/07	70%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

One of the most effective methods of controlling traffic noise is to reduce the noise generated at the source. One means to accomplish this is to absorb the sound on or near the roadway. Alternative noise barrier designs and treatments have been successfully utilized in other states and throughout Europe for a number of years to address different performance needs. In some situations these designs allow for the initial construction of a noise wall to be lower in height than a traditional wall. Also, retrofitting an existing wall with an innovative top section can reduce noise levels and eliminate the need for costly wall height increases or wall replacements. However, there is no comprehensive compilation of information on such traffic noise reduction products, materials, and designs.

RESEARCH OBJECTIVES

1. Determine what noise reduction products, materials, and technologies are currently available that have potential as noise mitigation alternatives.
2. Compile available performance information and discuss whether a full-scale testing program by the department is recommended.

EXPECTED IMPLEMENTATION

Based on the results of the tasks in this project, an assessment of the expected growth in the acceptability and use of the alternative noise mitigation approaches will be completed. The nature of, and amount of available quality performance information will also be determined. Recommendations will be developed on how ADOT can best proceed on this and whether a full-scale testing program is needed. Should such a testing program be recommended, ADOT will evaluate and decide accordingly.

STATUS OF THE RESEARCH

A Final report was promised for the end of April 2007. Efforts to have this report submitted to the department remains unsuccessful (August '07). A vendor performance report was completed for ADOT Procurement.

Environment

TECHNICAL ADVISORY COMMITTEE (TAC)

Mike Dennis – ADOT Environmental & Enhancement Group
Fred Garcia – ADOT Environmental & Enhancement Group
Steve Thomas – Federal Highway Administration
Frank Darmiento – Transportation Research Center
Estomih (Tom) Kombe – ATRC Project Manager

Environment

SPR-587, Evaluation of Salvage and Replanted Native Plants on ADOT Projects

Research Agency:	Logan Simpson Design, Inc.	FY Authorization:	2005
Principal Investigator(s):	Judy Melke, RLA	Contract Date:	06/05/2007
Contract Amount:	\$74,973	Original Completion Date:	03/31/2009
Program Budget:	\$75,000	Estimated Completion Date:	03/31/2009
Expenditures to date:	\$0	Is project on schedule?	Yes
Available Amount:	\$75,000	ADVANTAGE No.	R058717P
Percent complete Through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

ADOT in the construction of highway projects over the last 10 years has transplanted substantial quantities of plant species that provide a major contribution to the area ecosystem and visual quality of highway projects. The cost of this planting on many projects can run \$200,000 to \$300,000 per mile. On SR 87 and US 93 heavy emphasis was placed on salvaging and transplanting of Saguaros, Ocotillo, Barrel and Yucca and some native trees. The plants salvaged and replanted on projects are watered one or two years after replanting as plant establishment. Because of the nature of the plants they may not show survival or mortality until they have been in the ground for 3 to 8 years. Since a number of plantings have been in the ground 5 to 10 years an inventory based on the projects' plantings with an evaluation of survival and mortality would benefit the planning, design and construction of projects.

The salvage and replanting of plant materials can have a major visual and ecosystem effect on projects. At the present time no evaluations have been made that can contribute to our knowledge basis and towards improvement of project design. The Department annually spends several hundred thousand dollars per mile on salvaging and replanting on projects throughout the state. This would be a valuable expenditure when considering the cost for success and failure related to planting and re-establishment of these unique plants on highway projects

The resulting benefits would include the following:

- Since many of the species planted are in a time period when their survival or mortality can be determined, assessing the survival and mortality rate would provide information on species that salvage well and have a high level of survival.
- Research the contributing factors for survival and mortality.
- Develop additional criteria selection for salvage for replanting.

RESEARCH OBJECTIVES

1. Quantify survivability rates of transplanted saguaros, ocotillos, barrels, and trees on selected ADOT projects.
2. Quantify and compare survival rate of move-once saguaros to move-twice saguaros.
3. Determine the cost effectiveness of salvaging move-once and move-twice saguaros.
4. Quantify and compare the survival rates of small cacti and large cacti.

Environment

5. Determine cost-effectiveness of salvaging small and large cacti

EXPECTED IMPLEMENTATION

ADOT has a number of projects now reaching an age where salvage and replanting materials could be evaluated to provide effective determinations. An evaluation of salvage techniques and establishment techniques would enable the Department monies to be spent more effectively.

STATUS OF THE RESEARCH

Offers were evaluated and a recommendation for contract award made by the project TAC/Evaluation committee. Contract award was made to Logan Simpson Design, Inc. Project work is currently awaiting a Purchase Order and is scheduled to start in September 2007.

TECHNICAL ADVISORY COMMITTEE (TENTATIVE)

LeRoy Brady,	Roadside Development, ADOT (Champion);
Representative -	Tonto National Forest;
Vicki Bever	Natural Resource, ADOT;
William Knight -	EEG, ADOT.
Steve Thomas	FHWA
Mathew Moul	ADOT Globe District
Ted Littlefield	ADOT
Zitao Fang	ADOT, Roadside Development
Estomih Kombe	ADOT Project Manager, ATRC

Environment

SPR-588, A Study of the Effectiveness of Big Horn Underpasses on State Route 68

Research Agency:	AZ G&F Department	FY Authorization:	2005
Principal Investigator(s):	Jim DeVos	Contract Date:	08/09/2005
Contract Amount:	\$175,000	Original Completion Date:	12/31/2007
Program Budget:	\$175,000	Estimated Completion Date:	06/30/2008
Expenditures to date:	\$114,272	Is project on schedule?	Yes
Available Amount:	\$60,728	ADVANTAGE No.	R058817P
Percent complete Through 6/30/07	60%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Habitat fragmentation by highways generally creates species declines. For bighorn sheep, size of contiguous habitat is a critical factor determining population persistence. Arizona consists of 32 isolated bighorn sheep ranges of varying sizes, the Black Mountains in northwestern Arizona being the largest (>500,000 acres). The range contains the largest desert sheep herd in the U.S., and represents 31% of Arizona's sheep population. The Black Mountain herd also provides an important source population for transplants. Upgrades to SR 68 and U.S. 93 could create three smaller isolated patches of bighorn sheep habitat in the Black Mountains

Highway underpasses are used nationally to mitigate the effects of habitat fragmentation, yet few performance evaluations have been conducted (Foreman et al. 2003). Two underpasses were installed in the Black Mountains along SR 68 for wildlife crossing; however, their effectiveness remains largely unknown. Little is known about bighorn sheep use of underpasses elsewhere, or the factors that influence sheep use of crossing structures. Information is needed to ensure proper placement and design of passages on this and future highway projects planned in the Black Mountains.

RESEARCH OBJECTIVES

1. Quantify the effectiveness of SR 68 highway underpasses in facilitating bighorn sheep habitat connectivity in the Black Mountains.
2. Determine physical and biological factors that influence bighorn sheep use of these underpasses.
3. Recommend modification to wildlife crossing structures if necessary.

EXPECTED IMPLEMENTATION

With the results of this evaluation ADOT will be able to make informed decisions when opportunities arise during maintenance and new roadway constructions, for the upgrade to and installation of wildlife crossing structures of proven effectiveness.

STATUS OF THE RESEARCH

This project is now ongoing. The project team (AZ Game and Fish) continues to collect data within the study area. Data collection is scheduled to end around November 2007, at which time project effort will turn to data analysis and report writing.

Environment

TECHNICAL ADVISORY COMMITTEE (TAC)

Sam Elters	ADOT, Kingman District
Kara Hinker-Brambach	ADOT, Kingman District
John Reid,	Bureau of Land Management
Terry Brennan	US Forest Service
Jim Holland	U.S. National Park Service
Justin White	ADOT Environmental & Enhancement Group
Melissa Maiefski	ADOT Environmental & Enhancement Group
Steve Thomas	Federal Highway Administration
Ron Kearns	Fish and Wildlife Service
Jim DeVos	AZ Game & Fish Department
Kevin Morgan	AZ Game & Fish Department

Environment

SPR-589, Determination of 404 Permit and Habitat Restoration Requirements

Research Agency:	EcoPlan Associates, Inc.	FY Authorization:	2005
Principal Investigator(s):	George A. Ruffner, Ph.D	Contract Date:	04/27/2007
Contract Amount:	\$110,558	Original Completion Date:	06/30/2008
Program Budget:	\$125,000	Estimated Completion Date:	12/31/2008
Expenditures to date:	\$0	Is project on schedule?	Yes
Available Amount:	\$125,000	ADVANTAGE No.	R058917P
Percent complete Through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

ADOT recognizes that with the construction of highway projects and to waters of the U.S. and important habitat areas that there is an opportunity to re-establish and enhance quality wildlife habitat areas. The present Permits frequently require planting on a replacement of 3 to 1 with up to 80% survival in the fifth year of the permit. Based on review of these permit areas it is becoming apparent that these requirements are beyond a naturally sustainable level with a number of projects falling short of these requirements. Since habitat and native planting has not been studied these criteria are based on assumptions beyond what the various ecological systems appear to be able to support especially in a drought.

The present 7-year drought that we are experiencing has a very direct effect on the survivability of the plantings. At the present time no one area can provide information from which to make evaluations and determinations which would provide a basis for new project plantings and specifications. Values that are appearing with projects require additional time and effort of the various staff resources in setting up new projects and addressing value issues.

The resulting benefits would include the following:

- ADOT will be able to develop guidelines that recognize most successful species for planting for habitat restoration.
- Restoration of areas has a benefit not only to wildlife but also from a visual standpoint of the highway traveler.
- Development of guidelines would establish some uniformity and a basis for negotiations for 404 Permits (Clean Water Act, Section 404, regulating waste discharges to Waters of the United States) and habitat replacement with other agencies.
- At the present time with values on existing projects, replanting is expensive and may be non-productive.

RESEARCH OBJECTIVES

1. Identify Section 404 permits and habitat restoration requirements for ADOT projects that are under construction and within the reporting period for completion (3 to 5 years).
2. Assess the progress of the mitigation plantings towards meeting the section 404 permit habitat restoration mitigation requirements.

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3. Determine what plant species and 5-year density levels are reasonable and sustainable as related to reference plot conditions in nearby undisturbed habitats.
4. Develop criteria and guidelines for habitat establishment or replacement suitable for ADOT use in mitigation areas required by section 404 permits or for similar planting efforts that may be required by other agencies.

EXPECTED IMPLEMENTATION

At the present time we estimate ADOT spends over several thousand dollars a year for plantings on various projects throughout the state. Evaluations 3 or 4 years after these plantings are being made are beginning to indicate that many of these plantings are being made beyond the naturally sustainable level. The research would provide additional direction to the Department on realistic expectations and commitments.

STATUS OF THE RESEARCH

Project work is on-going. A contract award was made April 27th, 2007 to EcoPlan Associates, Inc.

TECHNICAL ADVISORY COMMITTEE (TAC)

LeRoy Brady,	Roadside Development, ADOT (Champion);
Representative -	Tonto National Forest;
Vicki Bever	Natural Resource, ADOT;
William Knight -	EEG, ADOT.
Steve Thomas	FHWA
Mathew Moul	ADOT Globe District
Ted Littlefield	ADOT
Zitao Fang	ADOT, Roadside Development
Estomih Kombe	ADOT Project Manager, ATRC

Environment

SPR-600, Effectiveness of Microbe Application to Petroleum Spills at Crash Sites

Research Agency:	N Weiss Associates, Inc.	FY Authorization:	2005
Principal Investigator(s):	Norm Weiss	Contract Date:	04-04-2006
Contract Amount:	\$15,000	Original Completion Date:	06/2008
Program Budget:	\$15,000	Estimated Completion Date:	06/2008
Expenditures to date:	\$4,500	Is project on schedule?	Yes
Available Amount:	\$10,500	ADVANTAGE No.	R060017P
Percent complete Through 6/30/07	35%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Hundreds of private and commercial vehicles crash on ADOT roadways yearly, often releasing fuel tank and engine contents onto ADOT property. This may result in soil contamination above regulatory action levels. Runoff from roadways is a nationally recognized storm water quality threat, prompting the California Department of Transportation, for example, to build extensive storm water protection devices. Storm water quality issues at ADOT have been addressed by a consent decree from ADEQ.

Petroleum releases from crashes pose a threat to storm water quality (both natural rain and runoff from fire departments at the crash site) and adjacent soils. One method commonly used to mitigate petroleum-contaminated soils is the application of petroleum-eating microbes to affected areas. ADOT would benefit from a research project, which would begin to answer these questions:

1. What environmental benefit, as measured by standard soil testing, might ADOT expect to obtain from applying a microbe solution to crash site spills as part of our first response to the incident?
2. How much would it cost to equip ADOT response teams to apply microbe solution?

The TRIS database contains 97 abstracts on storm water topics and 2 abstracts on petroleum contaminated soils. The Research in Progress database contains 43 abstracts on storm water topics and 1 on petroleum-contaminated soils. None were found that examined the impact of microbe application on a per-release (per crash, in this case) basis.

RESEARCH OBJECTIVES

1. Assess the effectiveness of microbe application by analyzing treated and untreated samples in a controlled field environment.
2. Determine the cost per response vehicle of preparing teams to apply microbe solution.
3. If applicable, recommend one or more microbe products for use by first response teams.

At a minimum the following tasks will be undertaken:

- Meet with project TAC to review the scope of work and work plan.

Environment

- Review the existing literature on microbe application, including asking microbe product manufacturers for input on applicable research.
- Select a research site or sites as necessary.
- Prepare, maintain, sample, and clean up test plots
- Prepare a detailed final report.
- Present results to the Research Council.

EXPECTED IMPLEMENTATION

The research will provide data that will enable the Agency to decide if it is cost effective to provide crash response teams with microbe application capability. Process owner of the study would be the Safety and Health Section. If implemented, the microbe application process would be owned by local maintenance groups/teams.

STATUS OF THE RESEARCH

The project is ongoing.

TECHNICAL ADVISORY COMMITTEE

Jeff Page	Safety and Health Section, Project Champion.
Courtney Perrier-Bear	ADOT Emergency Response
Steve Thomas	FHWA
Danny Peterson,	ASU Environmental Technology Management
Estomih Kombe -	ATRC Project Manager.

Environment

SPR-601, Cost Evaluation of Cross Border Truck Emissions Testing Using Heavy Duty Remote Sensing (HDRS) Equipment

Research Agency:	Prophecy Consulting Group, LLC	FY Authorization:	2005
Principal Investigator(s):	Violettee (Vi) Brown	Contract Date:	04-14-2006
Contract Amount:	13,100	Original Completion Date:	06/2007
Program Budget:	\$15,000	Estimated Completion Date:	12/31/2007
Expenditures to date:	\$7,638	Is project on schedule?	Yes
Available Amount:	\$7,361	ADVANTAGE No.	R060117P
Percent complete Through 6/30/07	10%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Trucks at Arizona Land Ports of Entry (LPOE) will soon be required to comply with new emissions standards set by the Environmental Protection Agency (EPA). The Arizona Department of Transportation (ADOT) is now responsible for Truck Safety inspections at the Border - Ports of Entry (LPOE). Trucks are to be detained at the border for these required emissions tests and this will likely occur alongside the current ADOT safety check.

Testing of truck emissions by remote sensing will promote fast tracking of trucks across the border and insure the required emissions testing programs will minimize border congestion. ADOT is in the process of upgrading and remodeling Arizona's LPOE. The design phase of these port improvements would be the ideal time to incorporate this new emission program.

EPA is currently establishing a comprehensive national control program that will regulate heavy-duty vehicle emissions. As part of this program, new emissions standards will begin in vehicle model year 2007. This research will study costs to test truck emissions at border crossings with Remote Sensing Technology. This involves projecting costs to install the Heavy Duty Remote Sensing (HDRS) equipment in the "Fast Lanes" at ADOT ports and also the costs of ongoing testing with HDRS. Developing border truck emissions control-testing strategies that employ remote sensing technology will provide the mitigation of congestion and fast tracking of trucks across the border. In turn this reduces air pollution at these sites from trucks idling for long periods.

PROJECT OBJECTIVES

The study objective is to perform a thorough evaluation of the feasibility and cost implications, initial installation and program costs, for a port of entry truck emissions program utilizing remote sensing technology.

EXPECTED IMPLEMENTATION

The first step will be to review current Remote Sensing technology and the costs to implement and maintain this technology at a LPOE. Using the results of this study ADOT will be able to

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make an informed evaluation to determine where this technology would be most useful and if applicable, how soon ADOT would be able to incorporate this into its testing program.

STATUS OF THE RESEARCH

The project is currently ongoing. A contract was awarded March 21st 2006 following an FOD solicitation process, and a purchase order made April 14th 2006 – which is the effective project start date. The first four project tasks are reported completed at this time. These tasks include the development of a work plan, conduct of a literature review, preparation of a data collection plan, and the implementation of the data collection plan.

TECHNICAL ADVISORY COMMITTEE

Beverly Chenausky, TPD Air Quality Programs
Colleen Crowninshield, Pima Association of Governments
Peter Hyde, Arizona DEQ
Ed Stillings, FHWA
Jermaine Hannon, FHWA
Estomih Kombe, ADOT Project Manager -ATRC

Environment

SPR-602, Sampling and Analyses of Storm Water Runoff on the Red Mountain Freeway - Loop 202

Research Agency:	Jacobs Civil, Inc./EEC	FY Authorization:	2006
Principal Investigator(s):	John Burton/Todd Ligon	Contract Date:	07/21/2006
Contract Amount:	\$39,987	Original Completion Date:	06/30/2008
Program Budget:	\$40,000	Estimated Completion Date:	06/30/2008
Expenditures to date:	\$800	Is project on schedule?	Yes
Available Amount:	\$39,200	ADVANTAGE No.	R060218P
Percent complete Through 6/30/07	30%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Storm water runoff associated with the Red Mountain Freeway (Loop 202) between Gilbert Rd. and Lindsey Rd discharges into two detention basins and a pump station prior to discharging into the Salt River. This storm water discharge is an important issue because it may carry a wide range of pollutants including nutrients, trash and debris, sediments, heavy metals, pathogens, petroleum hydrocarbons, and synthetic organics such as pesticides. Storm water runoff does not originate from a distinct “point” source (e.g., an industrial discharge pipe), and is often referred to as “non-point” source pollution. Currently, no data is available concerning this type of storm water runoff from Arizona Department of Transportation (ADOT) highways into such waterways. Acquiring this data will assist ADOT in determining appropriate best management practices (BMPs) to implement and how best to protect surface water quality.

The benefits from this study will give ADOT baseline data in determining what contaminants, if any, are entering the Salt River. The results of this data will be used to determine if BMPs are sufficient to protect surface water quality and to adjust BMPs as necessary.

RESEARCH OBJECTIVES

The objective of this monitoring program is to characterize the storm water entering each detention basin and the storm water entering the Salt River. Acquiring this data will allow ADOT to evaluate the effectiveness of its BMPs being implemented along this portion of the Loop 202.

EXPECTED IMPLEMENTATION

ADOT’s Central Maintenance group working with ADOT Roadside Development section will be responsible for reviewing implementation recommendations from this project.

STATUS OF THE RESEARCH

This project is on-going. Because data collection progress is dependent on occurrences of stormwater incidents, a longer project duration may be necessary to collect sufficient samples to allow for the conclusion of this effort.

Environment

TECHNICAL ADVISORY COMMITTEE

LeRoy Brady, ADOT Roadside Development - Champion

Colleen Kelly, Eco Plan Associates, Inc.

Jeff Beimer, ADOT Roadway Drainage Section

Steve Thomas, FHWA

Zitao Fang, ADOT Roadside Development

Environment

SPR-603, Evaluation of Measures to Minimize Wildlife-Vehicle Collisions & Maintain Wildlife Permeability – Kohls Ranch Section, State Route 260

Research Agency:	Arizona Game and Fish Department	FY Authorization:	2006
Principal Investigator(s):	Ray Schweinsburg	Contract Date:	11-10-2005
Contract Amount:	\$166,313	Original Completion Date:	06/2008
Program Budget:	\$166,313	Estimated Completion Date:	06/2008
Expenditures to date:	\$116,745	Is project on schedule?	Yes
Available Amount:	\$49,568	ADVANTAGE No.	R060318P
Percent complete Through 6/30/07	55%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Under Phase I (2004-2004) of the SR 260 research project we recorded 4,001 animals with video camera systems at the 1st 2 underpasses (UP), comparing use (e.g., 68% passage rate) and behavioral response. Based on this data, ADOT made major design changes to the UP on the Kohls Ranch (KR) Section. We accrued 101,500 fixes from 33 elk fitted with GPS satellite tracking collars, and identified 3,057 highway crossings and assessed permeability. This data was used to determine the extent of elk-proof fencing needed to intercept and funnel elk to UP, maximizing UP effectiveness. In the KR Section, adding fencing to 25% of the section is projected to intercept 60% of the elk crossings. We compared GPS crossings to nearly 500 wildlife-vehicle collisions (WVC) from 1994-2004, and compared collisions before and after highway reconstruction. Under Phase II (2004-2006), we've fitted 29 elk and 7 whitetail deer with GPS collars. Video surveillance has been ongoing at 4 UP on the Christopher Creek (CC) Section since 2004, with 1,158 animals recorded; passage rates have been low (23%). With additional UP video assessment, we will be able to conduct multivariate analysis of factors affecting wildlife use and UP effectiveness and assess long-term changes in usage. This project will provide long-term data on wildlife use of UP and permeability, as well as assess the effectiveness of adaptive management changes made on the KR Section.

In summary, project benefits include - 1) Highway safety - WVC reduction, 2) enhanced long-term research and insights for future application, 3) increased effectiveness of wildlife measures, 4) enhanced standing for ADOT on liability issues involving WVC, 5) enhanced decision making on future highway applications, 6) continued commitment to sound project management principals, 7) national leadership in innovative application of UP

RESEARCH OBJECTIVES

1) Analyze collisions to assess effectiveness of UP and fencing in reducing WVC, 2) install video camera system to assess wildlife use of the new KR Section UP, 3) fit 6 elk with GPS collars on the KR Section, and track those collared in Phase II to assess elk permeability after reconstruction, 4) continue to monitor the 6 UP with video systems already in place to yield long-term data, and 5) continue to work closely with ADOT managers to improve the effectiveness of wildlife measures.

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EXPECTED IMPLEMENTATION

The results of our management-oriented research will support ongoing adaptive management with ADOT to develop and implement effective UP structures and determine fencing needs. Insights from this research will be used to develop guidelines for future underpasses.

STATUS OF THE RESEARCH

The project is ongoing. During the spring and summer 2006, the task of trapping and attaching GPS collars to wildlife was completed. In subsequent months other animal monitoring activities have continued without any setbacks to date.

TECHNICAL ADVISORY COMMITTEE

Bruce Eilerts	ADOT Natural Resources, Champion
Mike Ross	Tonto National Forest
Doug Brown	AZ Dept. of Administration
Norris Dodd	AZ Game & Fish Dept., Research Leader
Ray Schweinsburg	AZ Game & Fish Dept
Steve Thomas	Federal Highway Administration
Terry Brennan	Tonto National Forest
Melissa Maiefski	ADOT Environmental & Enhancement Group
Tom Kombe	ADOT Research Project Manager, ATRC

Environment

SPR-619, Study of Antelope Movements North of Interstate 40 in Arizona

Research Agency:	Arizona Game and Fish Department	FY Authorization:	2006
Principal Investigator(s):	Norris Dodd	Contract Date:	11/24/2006
Contract Amount:	\$197,000	Sched. Completion Date:	06/30/2009
Program Budget:	\$197,000	Est. Completion Date:	06/30/2009
Expenditures to date:	\$52,656	On schedule?	Yes
Available Amount:	\$144,344	ADVANTAGE No.	R061918P
Percent complete through 6/30/07	20%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Historically, as many as 4,500 pronghorn antelope moved freely throughout northern Arizona in response to climatic variations. These meta-populations were restricted in movement only by a few natural barriers. The landscape movements available to historic pronghorn populations allowed for survival through catastrophic climatic events, such as heavy snow or prolonged drought, or to take advantage of favorable conditions within a portion of their range. Over the last century, however, roads and fences were constructed in northern Arizona and throughout the west to meet the needs of a growing human population. The development of roads and fences created ever-increasing barriers to the once free-ranging movements of pronghorn meta-populations. Many highways across the west are constructed in broad, open terrain that pronghorn need to sustain a viable population. Subsequently, pronghorn habitat became fragmented across northern Arizona and the west. As a result, pronghorn populations were isolated, movements restricted, and they suffered major population declines. The decline of the once vast pronghorn populations of northern Arizona is a major concern to wildlife managers. Arizona Game and Fish Department (AGFD) studies continue to show pronghorn antelope populations confined by barriers of fencing and roadways. AGFD believes the loss of historic connectivity (genetic and collective population memory loss) that provided access to habitats capable of supporting populations during catastrophic climatic events are contributors to stagnation of Arizona's pronghorn populations.

Research studies throughout Arizona and throughout the United States that have evaluated highway crossings for large mammals mostly assessed the effectiveness of underpasses or culverts, which pronghorn are known to avoid because of their unique behavior for detecting and avoiding danger. Additionally, many of the crossings are not constructed within occupied pronghorn habitat. In order to provide wildlife managers and highway design engineers throughout the western United States with the information needed to ensure unobstructed movement of pronghorn across wide, high-speed freeways; research specifically designed with the habitat and biological requirements of pronghorn is required. Specific research is needed to determine how to reconnect pronghorn meta-populations that have been fragmented by highways. Because pronghorn use acute eyesight to detect danger and fleetness to escape it, they prefer open areas with little to no visual or physical obstructions. Thus, it is expected that an overpass that allows pronghorn unobstructed views is the most likely type of structure that pronghorn would use to cross a highway. However, this has never been tested, leaving highway

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engineers and wildlife managers without precise data on an effective highway design or wildlife crossing structure for facilitating pronghorn movement. The proposed US 89 Antelope Hills – Junction US 160 project provides a unique opportunity to study pronghorn movements, and recommend design and placement of pronghorn crossing structures within occupied habitat that may support unrestricted pronghorn movement. This research could provide the information required by highway engineers throughout the western United States to address concerns of highway impacts to fragile pronghorn populations.

RESEARCH OBJECTIVES

Specific research objectives include:

1. Assess pronghorn movement patterns and distribution relative to US 89 and determine permeability across the highway corridor
2. Investigate the relationships of pronghorn highway crossing and distribution patterns to vehicular traffic volume
3. Assess the influence of fencing on pronghorn highway crossing patterns and permeability
4. Investigate wildlife-vehicle collision patterns along US 89
5. Assess the degree to which US 89 and other northern Arizona highways have affected gene flow and genetic diversity among pronghorn populations
6. Develop recommendations to enhance pronghorn highway permeability.

EXPECTED IMPLEMENTATION

The Arizona Game and Fish Department will conduct both aspects of the research designs. ADOT management will determine whether, and if so, where, to construct a crossing structure, associated drift fencing, and roadway modifications.

STATUS OF THE RESEARCH

The Arizona Game and Fish Department continues with the execution of this project with good progress.

TECHNICAL ADVISORY COMMITTEE (TAC)

John Harper & Steve Moore, ADOT Flagstaff District
Justin White, ADOT EEG Flagstaff
Steve Thomas, FHWA
Steve Michelson, National Park Service
Cary Thompson, National Forest Service
Ray Schweinsburg, Arizona Game and Fish Department
Pamela Kyselka, Navajo Fish and Wildlife

Environment

SPR-624, Hazardous Materials Transportation in Arizona

Research Agency:	Pending	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	Pending
Program Budget:	\$53,000.00	Est. Completion Date:	Pending
Expenditures to date:	\$0	On schedule?	N/A
Available Amount:	\$53,000.00	ADVANTAGE No.	R062419P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Currently, hazardous materials routing in Arizona is limited to the avoidance of three locations: the I-10 deck park tunnel, the U.S. 60/S.R. 101 loop ramp, and the S.R. 202 Salt River bridge. As Arizona's population grows and highway infrastructure increases, the issue of routing needs to be re-assessed. In the last three months alone, ADOT has been questioned about possible hazardous materials routes for the proposed Tucson tunnel and the South Mountain freeway. In order to address issues related to hazardous materials routing, ADOT needs to acquire current data on hazardous materials transport and a methodology for determining alternate routes. Hazardous materials transportation and bypass routing is of interest to the Environmental and Enhancement, Transportation Services, and Traffic Groups in ADOT. Current information on hazardous materials transport will also be of use to planners within Department of Public Safety, Division of Emergency Management and various first responder agencies. The results of a hazardous materials survey and a methodology for determining bypass routes will be useful for both safety and decision-making purposes.

RESEARCH OBJECTIVES

The first objective is to assess the types and amounts of hazardous materials currently transported on Arizona's State and U.S. Highways. (The Interstates and U.S. 60 are excluded because they are part of a similar study by the Arizona Emergency Response Commission.) Placard surveys will be conducted in locations with an annual average daily traffic count >10,000 and a truck count >15% (see attachment). The second objective is the derivation of a suggested methodology for determining hazardous materials bypass routes. This result should be general so that it can be re-applied due to changes in population, highway infrastructure or the nature of hazardous material transport in the state.

EXPECTED IMPLEMENTATION

The data on hazardous materials transport on Arizona's Highways will be published and available for use by ADOT and other agencies. The method for determining bypass routes will be available for implementation by ADOT personnel as the need arises.

STATUS OF THE RESEARCH

Pending. Scope of work document submitted to Procurement for solicitation of consultant services.

Environment

TECHNICAL ADVISORY COMMITTEE (TAC)

- Tammy Flaitz – Environmental Planning (Sponsor)
- Angela Roach – Environmental Planning, (Champion)
- Jeff Page – Health and Safety
- Ed Green – Environmental Planning
- Bill Tait – Emergency Manager
- Mike Manthey/Reed Henry (alternates) – Traffic Group
- Steve Thomas – FHWA
- Tom Kombe – ATRC Project Manager

Environment

SPR-626, State Route 64 Wildlife Accident Reduction Study Monitoring

Research Agency:	Arizona Game and Fish Department	FY Authorization:	2007
Principal Investigator(s):	Ray Schweinsburg	Contract Date:	07/27/2007
Contract Amount:	\$195,600	Sched. Completion Date:	06/30/2010
Program Budget:	\$195,600	Est. Completion Date:	06/30/2010
Expenditures to date:	\$0	On schedule?	Yes
Available Amount:	\$195,600	ADVANTAGE No.	R062619P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Highways cause direct mortality to wildlife from wildlife-vehicle collisions (WVC) and create barriers to crossing animals. With increasing motorist use of Arizona's rural highways, these impacts are intensifying, as are safety and property damage concerns with WVC. For State Route (SR) 64, the main highway access to the Grand Canyon, a proactive Wildlife Accident Reduction Study was completed in 2006. This study addressed the high incidence of WVC along 50 miles of this high traffic volume highway; WVC accounted for 48% of all accidents from 1998-2003. This purpose of the study was to identify and evaluate alternatives to reduce WVC (and enhance permeability) for incorporation into a feasibility study being developed for the reconstruction of SR 64; this study identified numerous sites for future passage structures. However, this report also identified interim monitoring needs to provide information or address questions in support of the feasibility study and future reconstruction.

RESEARCH OBJECTIVES

To address the monitoring needs in the SR 64 Wildlife Accident Reduction Study, the research objectives of this proposed project include:

1. Assess elk, mule deer, and pronghorn movements, highway crossing patterns, and distribution relative to SR 64 and determine permeability across the highway corridor,
2. Investigate the relationships of elk, mule deer, and pronghorn highway crossing and distribution patterns to vehicular traffic volume along SR 64,
3. Assess the degree to which the existing Cataract Canyon Bridge is currently used by wildlife for below-grade passage,
4. Investigate wildlife-vehicle collision patterns along SR 64 and relationships to elk, mule deer, and pronghorn movement and highway crossing patterns,
5. Assess the degree to which SR 64 and other northern Arizona highways have affected gene flow and genetic diversity among pronghorn populations (NOTE: this is an OPTIONAL objective dependent on additional funding), and

Environment

6. Develop recommendations to enhance elk, mule deer and pronghorn highway permeability through the application of wildlife passage structures and ungulate-proof fencing.

EXPECTED IMPLEMENTATION

The results will be used to refine plans for reconstruction of SR 64 to meet wildlife passage and permeability as part of the feasibility study being conducted, as well as be incorporated into scientific journal manuscripts and compliment wildlife-highway research collected elsewhere in Arizona.

STATUS OF THE RESEARCH

The project was just initiated and is now on-going. The Arizona Game and Fish Department leads this project effort under a Joint Project Agreement with ADOT.

TECHNICAL ADVISORY COMMITTEE (TAC)

- John Harper – Flagstaff District (Sponsor)
- Justin White – Environmental Planning, Flagstaff (Champion)
- Ray Schweinsburg – Arizona Game and Fish Dept.
- Jeff Waters – Forest Service, Kaibab NF
- Steve Mitchelson – National Park Service (tentative)
- Steve Thomas – FHWA
- Tom Kombe – ATRC Project Manager

Environment

SPR-638, Research for Mobile Source Air Toxics (MSATs) in Maricopa County

This project was cancelled August 21st, 2007 following input on related developments. The project sponsor, champion, and ATRC project manager agreed that it was no longer needed as proposed.

Research Agency:	N/A	FY Authorization:	2006
Principal Investigator(s):	N/A	Contract Date:	N/A
Contract Amount:	N/A	Sched. Completion Date:	N/A
Program Budget:	\$15,000	Est. Completion Date:	N/A
Expenditures to date:	\$0	On schedule?	N/A
Available Amount:	\$15,000	ADVANTAGE No.	R063818P
Percent complete through 6/30/07	N/A	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Mobile Source Air Toxics (MSATs) have been identified by the Federal Highway Administration (FHWA) as an emerging issue, due, in large part, to the successful challenges issued to construction of large freeway projects using MSATs as a basis. Roadways in Nevada, Maryland, California, and Tennessee have all become controversial based on MSAT related issues. In Nevada, US95 was delayed, and multiple additional commitments were required of FHWA and the Nevada Department of Transportation before construction could proceed. Similar confrontations are becoming evident in the Phoenix region, challenging several high profile projects in Maricopa county, among them improvements to highway 202 (South Mountain), the I-10 widening, the new alignment SR 801, route 303, and others. Local opposition is joined by the Sierra Club, the group responsible for ultimately interrupting construction of the US95 in Nevada. Active local groups such as PARC are well organized and have been successful in obtaining substantial media coverage of their concerns. The Arizona Department of Transportation (ADOT) needs to provide an accurate, balanced, and comprehensible summary of risks and perspectives so that small numbers of people with limited information do not adversely impact overall transportation issues needlessly.

RESEARCH OBJECTIVES

Identify the most recent and reliable information regarding MSATs: past, present, and anticipated future emissions. Estimate, as accurately as possible, risks and potential impacts on human health. Working with the particular concerns of the areas near ADOT projects, place these issues in context with other health impacts, other pollution risks, and develop summary information appropriate for public distribution. Work with other agencies (e.g., Maricopa Association of Governments, FHWA, Maricopa County, Arizona Department of Environmental Quality, etc.) to assure, at a minimum, no conflicts between presented information.

EXPECTED IMPLEMENTATION

It is anticipated that ADOT will employ an on-call consultant with the Environmental Planning Group to perform the research and prepare summary and educational materials.

Environment

STATUS OF THE RESEARCH

In view of developments since this proposal was submitted and funded, it was recommended that the project should be cancelled as it was no longer needed as proposed.

TECHNICAL ADVISORY COMMITTEE (TAC)

Project Champions (required): Fred Garcia, Mike Dennis

Project Sponsor (required): Thor Anderson

Proposed Technical Advisory Committee:

Thor Anderson, Environmental Planning Program Manager

Mike Dennis, Air Noise Team Leader, EEG

Fred Garcia, Air/Noise Specialist, ADOT EEG

Lisa Andersen, Senior Air Quality Planner, ADOT EEG

Beverly Chenausky, Senior ADOT Transportation Planning Division

Environment

SPR-647, Elk Movements Associated with a High-Traffic Highway: Interstate-17

Research Agency:	Pending	FY Authorization:	2008
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	Pending
Program Budget:	\$250,000.00	Est. Completion Date:	Pending
Expenditures to date:	\$0	On schedule?	N/A
Available Amount:	\$250,000.00	ADVANTAGE No.	R064720P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Wildlife-vehicle collisions (WVC) cause tremendous property damage, human injuries and deaths, and substantial mortality to wildlife. Highways present barriers to the free movement of wildlife from reduced permeability and can fragment and isolate populations. Insights gained from ATRC-funded research along State Route (SR) 260 (Dodd et al. 2007) illustrated the impact of highway reconstruction on WVC and elk permeability, as well as the benefit (to safety, wildlife, and economics) of mitigation measures such as underpasses and fencing to reduce WVC and promote elk permeability. This study also shed light on the relationships to vehicular traffic volume to wildlife passage. Traffic on SR 260 (< 9,000 AADT) only occasionally posed a barrier to elk during peak volume periods. A small proportion of the elk (22%) crossed the highway frequently (>0.4 crossings/day), yet accounted for 87% of the collisions with vehicles.

WVC along Interstate-17 (I-17) present a significant safety and liability concern, particularly those involving elk between MP 310-325 where WVC constitute the single greatest cause of crashes. ADOT funded an ongoing pilot study assessment of elk movements and permeability here in 2005. Preliminary results of this study show that I-17 presents a significant barrier to wildlife passage compared to SR 260, owing to its high traffic volume (>17,500 AADT); we suspect that like SR 260, relatively few elk account for most accidents, though our small sample size has yet to include such elk. The potential exists in working with the ADOT Flagstaff District to address the incidence of WVC through fencing that will link existing structures (e.g., bridges and large box culverts) to create wildlife passages, which may also improve wildlife permeability as done on SR 260. Research here will complement that done on SR 260 and provide valuable insights into the impact of high traffic volumes on wildlife (heretofore only theoretical) and ability to mitigate highway impact under such traffic volumes.

RESEARCH OBJECTIVES

This project will continue and expand upon a pilot elk movements study ongoing since 2005. Objectives include:

- 1) Assess elk movements, distribution, and crossing patterns, and assess elk permeability by GPS telemetry,
- 2) Investigate the relationships of elk crossing and distribution patterns to traffic volume (using a newly installed traffic counter),

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- 3) Validate and refine our model assessing the influence of various environmental parameters developed for SR 260,
- 4) Investigate wildlife-vehicle collision patterns, and
- 5) Develop recommendations for the retrofitting of existing and reconstruction of new wildlife passage structures and other mitigations to reduce WVC and promote permeability

EXPECTED IMPLEMENTATION

The results of this project will be used by the ADOT Flagstaff District to develop short-term strategies to reduce WVC and promote wildlife permeability along I-17 through fencing of high incidence elk crossing zones and collision hotspots. The results will also be integrated into design concept planning for future reconstruction.

STATUS OF THE RESEARCH

Pending

TECHNICAL ADVISORY COMMITTEE (TAC)

Todd Williams, ADOT Environmental Services, Project Champion

John Harper, ADOT Flagstaff District, Project Sponsor

Chuck Howe, ADOT Flagstaff District

Steve Thomas; Federal Highway Administration

Bruce Eilerts, ADOT Natural Resources

Cindy Eiserman, ADOT Risk Management

Ray Schweinsburg, AGFD Research Branch

Chris Fetzer, Northern Arizona Council of Governments (NACOG)

Henry Provencio, US Forest Service

Estomih Kombe, ATRC Project Manager

Environment

SPR-650, Predicting Desert Tortoise (*Gopherus agassizii*) Habitat and Identifying Movement Patterns within the Proposed Highway 95 Realignment

Research Agency:	Pending	FY Authorization:	2008
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	Pending
Program Budget:	\$346,000	Est. Completion Date:	Pending
Expenditures to date:	\$0	On schedule?	N/A
Available Amount:	\$346,000	ADVANTAGE No.	R065020P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

State Route 95 has been proposed for expansion through one of the important desert tortoise Key Habitat Areas (KHA) within the State, and could irreversibly fragment the area if not properly placed and designed. Preliminary work within the KHA suggests a correlation between tortoise activity and Aridisol soil types, and shows promise as a tool to assist in proper placement of the new highway. Without this tool biologists lack the ability to predict and quantify important tortoise areas, and therefore fully assess the threat from the proposed Highway 95 project. Once proper placement of the alignment is determined, specific crossing structures to facilitate safe tortoise passage is needed. Two general variables are critical to the success of wildlife crossings: location and design. To determine the number and location of crossing structures, tortoise movement patterns must be understood prior to highway design. Finally, the proper type of crossing structures must be incorporated at each previously identified location so as to ensure an effective wildlife mitigation package for this highway project.

RESEARCH OBJECTIVES

1. Develop and validate a soil-based predictive model for desert tortoise occupancy to quantify potential impacts from proposed SR 95, and to recommend specific placement of the alignment
2. Using GPS tracking devices, identify areas along the proposed SR 95 realignment for the potential placement of underpass structures to facilitate safe tortoise passage
3. Determine effectiveness of existing crossing structures and associated fencing constructed to facilitate the crossing of desert tortoises on Highway 93, and;
4. Provide insight (management recommendations) for improvement and assess feasibility of similar mitigation for proposed Highway 95 project in the Black Mountain area.

EXPECTED IMPLEMENTATION

This project will help ADOT with compliance issues relevant to this sensitive species. Results for this project will allow for roadway designers to place the new highway 95 realignment in an area that has the least impact on desert tortoises, thereby reducing any possible delays caused by litigation. In addition, results from this study will allow for the most efficient placement of roadway underpasses for desert tortoises, potentially saving dollars from arbitrarily placing structures where they are not needed.

Environment

STATUS OF THE RESEARCH

Pending

TECHNICAL ADVISORY COMMITTEE (TAC)

Julie Alpert, Environmental Coordinator Kingman District (Champion)

Julie Alpert & Victor Yang, Manager Roadway Predesign (Sponsors)

Michael Ingraldi, Game and Fish Dept.

Kevin Morgan, Game and Fish Dept.

Bruce Eilerts, ADOT Natural Resources

Steve Thomas, Federal Highway Administration

Estomih Kombe, ATRC Project Manager

ITS

Intelligent Transportation Systems (ITS) – PROJECTS

SPR-473, Arizona Intelligent Vehicle Systems Evaluation

Research Agency:	ADOT - ATRC	FY Authorization:	1998
Principal Investigator(s):	ATRC Staff (Owen)	Contract Date:	None (in-house)
Contract Amount:	None (in-house)	Sched. Completion Date:	06/30/98
Program Budget:	\$295,029	Est. Completion Date:	12/31/07
Expenditures to date:	\$291,145	On schedule?	Yes
Available Amount:	\$3,884	ADVANTAGE No.	R0473 17P
Percent complete through 6/30/07	99%	Responsible ATRC Staff: (Project Manager)	Steve Owen

PROBLEM STATEMENT

This Intelligent Vehicles (IV) project was originally the result of ADOT visits to the National Automated Highway Systems (AHS) Demonstration in San Diego, California in 1997. After successful early AHS demonstrations in Arizona, the project evolved to focus on ITS-based driver assistance and snowplow truck safety systems for ADOT maintenance crews in severe winter conditions. This is an in-house project of the Arizona Transportation Research Center.

RESEARCH OBJECTIVES

One key objective of this ongoing research project is to implement advanced snowplow systems for enhanced operator safety and operational efficiency. Another objective is further research into the potential of intelligent vehicle systems to enable more advanced, safer fleet vehicles.

EXPECTED IMPLEMENTATION

This ongoing project will identify promising areas for deployment of ITS-IV systems in Arizona. It will conduct research, tests, and demonstrations in the areas of vehicle guidance and warning systems, and related ITS technology. The current focus is on technologies to improve the safety and efficiency of maintenance operations, and to promote implementation of these systems.

STATUS OF THE RESEARCH

Eight winters of testing and evaluation have been completed. Project reports were published in February 01, May 02, September 03 and January 04, covering five winters of active research. Internal implementation reports were prepared in August 04 and July 05. A final internal report was completed in July 06, detailing tests of blind-spot warning systems over the 2005-06 winter. The ATRC will continue to monitor and support implementation of these systems through 2007.

Initially, this project evaluated Intelligent Vehicle technology for congestion relief. A concept study was done for dedicated AHS lanes on I-10 from Phoenix to Tucson. Magnet-guided, fully-automated cars were demonstrated in late 1997 on a closed course in Tempe. In early 1998, another live demonstration utilized cars with machine-vision guidance on a segment of I-10.

ADOT's focus then shifted to winter maintenance. In 1998-99, ADOT and Caltrans (California DOT) jointly evaluated their prototype magnet-guided RoadView snowplow on a six-mile test

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site on US 180 near Flagstaff. The Caltrans plow was transferred to Arizona for a month of tests each winter, for four years. Also, for the third winter, an ADOT snowplow was equipped for tests of the new 3M magnetic tape guidance system, on five miles of US 89 near Sunset Crater. Winter testing of the 3M Lane Awareness System in 2000-01 and 2001-02 was a success.

After four winters of evaluations of both the Caltrans and 3M lane guidance systems, it was clear that roadway-based infrastructure systems were too costly for Arizona, where true whiteout storm conditions were not frequent enough to justify these advanced, semi-automated systems.

The focus shifted in 2002 to commercial on-board warning systems for low-visibility conditions. Four Eaton VORAD Collision Warning Radars, and three Bendix XVision infrared night vision systems were deployed across three districts by early 2003. The 2002-03 winter was mild, which limited the test results. This was the last winter of active monitoring of a regional deployment. Report 473(4) detailed the concepts and the issues with deployment of these on-board systems.

The 473 research program was extended, to support implementation. After another mild winter in 2003-04, ATRC prepared a brief internal report (473(5)). The wet 2004-05 winter gave the two warning systems a better trial, but with mixed results due to driver and route variability. The next internal report (473(6)) recommended more collision-warning radars, but none were added.

The project remains currently active to support operations with both advanced warning systems. A new type of low-cost blind-spot radar warning device was tested in 2006, compared with rear camera units. This evaluation was very successful, and internal report (473(7)) recommended wider use of rear-warning radars. In 2007, these units were placed on a state procurement contract, and several ADOT districts have begun to install them on high-use vehicles.

TECHNICAL ADVISORY COMMITTEE (TAC)

M. Kondelis, R. Spurlock, T. Steinberger, B. Mejia	Kingman Maintenance District
J. Harper, K. Link, D. Russell, L. Anderson,	Flagstaff District
J. Robbins, M. Gutzwiller	
L. Johnson, R. Routhier, F. Perkins, G. Nastacio	Holbrook District
D. Halachoff, L. Presnall, C. Eyrich, J. Servin,	ADOT Equipment Services
S. Carspecken, D. Murguic	
Lt. J. Gerard	Arizona Department of Public Safety
G. Howard	National Weather Service / NOAA
S. Nodes (sponsor)	ADOT Transportation Technology Group
A. Hansen	Federal Highway Administration

ITS

SPR-604, Real-time Adaptive Ramp Metering: Phase 2 – Implementation and Enhancement

Research Agency:	University of Arizona	FY Authorization:	2006
Principal Investigator(s):	Dr. Pitu Mirchandani	Contract Date:	01/19/07
Contract Amount:	\$200,000	Sched. Completion Date:	08/31/08
Program Budget:	\$200,000	Est. Completion Date:	08/31/08
Expenditures to date:	\$5,764	On schedule?	Yes
Available Amount:	\$194,236	ADVANTAGE No.	R0604 18P
Percent complete through 6/30/07	05%	Responsible ATRC Staff: (Project Manager)	Steve Owen

PROBLEM STATEMENT

ADOT's Freeway Management System (FMS) is designed for "smart" ramp metering, considering the ramp impacts on mainline traffic flow, but real-time traffic-adaptive metering has never effectively been deployed. New FMS upgrades will allow full utilization of control strategies, such as University of Arizona's MILOS program, to smooth traffic flows and improve regional operations. Phase 1, the recent SPR 595 research, was the "proof of concept" for integration of existing ADOT systems with new traffic management programs and firmware, so that the optimum metering rates, as determined by MILOS, can be downloaded to the ramps.

This new Phase 2 project will implement MILOS, evaluate its operation, and identify required operational enhancements. It will deploy MILOS as an operational prototype system that can be field tested by ADOT operations staff to more efficiently manage freeway corridor operations.

RESEARCH OBJECTIVES

The new Phase 2 effort will evaluate the performance of MILOS in field operational conditions. Initially, MILOS will be operated in "shadow mode" to observe functionality, and to identify strengths and weaknesses as well as any needed enhancements. Solutions will be developed to address needs and deficiencies, tested using simulation, and implemented in the operational system. The program will then be run on-line to develop data to compare and evaluate both the "MILOS-ON" and "MILOS-OFF" performance.

EXPECTED IMPLEMENTATION:

This research, for the first time, would fully utilize technologies and capabilities that are already available in the existing ADOT ramp metering system, which is available for "smart" ramp metering, but was never configured to do so. A new traffic-adaptive ramp metering system will be incorporated into ADOT's FMS operations.

Implementation could begin to occur within two years on a corridor-priority basis. Significant benefits to the regional freeway system would include a decrease in congestion, and increased throughput on freeway networks, as well as improved efficiency and safety, reductions in resource consumption, and improved air quality.

STATUS OF THE RESEARCH

The 604 project was initiated with a kickoff TAC meeting in February 2007. Initial program tasks have involved simulation modeling, integration testing, and algorithm development. In the

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fall, bench testing will be initiated to establish the basis for field testing of MILOS, which is targeted for Months 12-14 of the project.

TECHNICAL ADVISORY COMMITTEE (TAC)

S. Nodes (sponsor)	Transportation Technology Group / TOC Manager
D. Bingham, G. Jonas, L. Warnick	Transportation Technology Group – TOC
T. Parlante	Traffic Engineering Group
J. McGuirk	Phoenix Maintenance District
S. Joshua	Maricopa Association of Governments (MAG)
D. Wolfson	Maricopa County DOT
J. Decker, C. Warren	City of Tempe
J. Siefert	City of Phoenix
A. Hansen	Federal Highway Administration

ITS

SPR-615, ITS Concepts for Rural Corridor Operations

Research Agency:	ITS Engineers	FY Authorization:	2006
Principal Investigator(s):	Michael Wendtland	Contract Date:	07/20/06
Contract Amount:	\$99,960	Sched. Completion Date:	06/30/07
Program Budget:	\$125,000	Est. Completion Date:	08/31/07
Expenditures to date:	\$84,584	On schedule?	Yes
Available Amount:	\$40,416	ADVANTAGE No.	R0615 18P
Percent complete through 6/30/07	85%	Responsible ATRC Staff: (Project Manager)	Steve Owen

PROBLEM STATEMENT

ATRC project SPR-457 developed a Statewide ITS Architecture in 1998, which later was used to prepare Arizona's statewide deployment plan for Intelligent Transportation Infrastructure (ITI). Several years later, project SPR-570, a Rural ITS Progress Study for Arizona, was performed in 2004. This project developed a summary matrix for 18 key ITS systems, showing the information types, capital and operating costs, and benefits or advantages of each deployment.

Project 570 delivered 20 specific final recommendations for ADOT to improve the performance, reliability, and return on investment of the State's rural ITI.

ADOT had made significant progress in many rural ITS areas since 2004, but as of mid-2006, a number of the recommendations from SPR-570 still required further attention. Project 615's Technical Advisory Committee identified five key Project 570 recommendations out of the 20, that as of the project kickoff meeting were not effectively, fully, or consistently implemented:

- Rural ITS Maintenance
- Motorist Assist Patrols
- Weather Information Systems
- Information Sharing
- Highway Advisory Radio

RESEARCH OBJECTIVES

Project 615 will evaluate new systems and concepts in light of Arizona's terrain, weather, traffic, roadway design, infrastructure, and agency parameters. The best of the potential solutions will be applied to ADOT's five key gap areas as identified from the Project 570 Recommendations.

PROJECT APPROACH

A *Global ITS 'State of the Practice' Review* will identify and evaluate advances in rural ITS technology through a detailed Internet survey and literature search of relevant new products and innovations from the global ITS industry, commercial vendors, and academia. At the same time, a similar Internet and literature survey will review innovative rural ITS systems and business plans by other State DOTs, and recommend the best models for ADOT.

A *Milestone 'State of the Practice' Report* will present results to the TAC, to select best practices and systems that will meet ADOT's needs. Key factors include practicality and compatibility,

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reasonable limits on cost, and clear and measurable results on the roadway. An Interim Report will be prepared for the TAC on the ‘State of the Practice’ nationally in rural ITS.

A *Gap Solutions Implementation Plan* will be developed to enable the effective completion of actions on the five key SPR 570 recommendations. A comprehensive SPR 615 Implementation Plan Interim Report will be developed for TAC approval of the gap solutions. This Plan will enable completion of the remaining tasks, and the project Final Report.

EXPECTED IMPLEMENTATION

Project 615 will recommend effective and practical ITS resources for roadway management, and for public safety and security. The results will improve ADOT’s ability to manage its statewide transportation system, and will enhance its performance in day-to-day operations. The ADOT Transportation Technology Group and ADOT-ITD senior management will be the primary parties to develop future action items, based on the Project 615 findings and recommendations.

STATUS OF THE RESEARCH

The project was initiated in July 2007 in a kickoff meeting, followed by early ‘needs assessment’ meetings in each rural ADOT district. A series of interim reports were developed on the known gap areas, other rural ITS needs, the current ITS state of the practice, and relevant DOT business models. An extensive Implementation Plan was then prepared, and a general TAC consensus achieved. Work was begun in May 2007 on the research Final Report.

TECHNICAL ADVISORY COMMITTEE (TAC)

S. Nodes (sponsor)	Transportation Technology / Traffic Operations Center
M. Kondelis, C. Morris	Kingman District
J. Harper	Flagstaff District
R. Routhier, L. Johnson	Holbrook District
D. Hammitt	Prescott District
B. Harmon, T. Engel, S. Puzas	Safford District
R. Powers, J. Miller	Globe District
R. Karimvand	Tucson District
P. Patane, M. Jones	Yuma District
A. Zubi, R. Amavisca	ADOT – ITD Traffic Operations
H. Homberg, D. Bui	ADOT Information Technology Group
L. Scarber, B. McCance, D. Henry	Arizona Department of Public Safety
B. Klimowski	National Weather Service / NOAA
A. Hansen	Federal Highway Administration

ITS

SPR-627, State-of-the-Art Evaluation of Traffic Detection and Monitoring Systems

Research Agency:	Texas Transportation Institute	FY Authorization:	2007
Principal Investigator(s):	Dan Middleton	Contract Date:	02/12/07
Contract Amount:		Sched. Completion Date:	06/30/09
Program Budget:	\$200,000	Est. Completion Date:	06/30/09
Expenditures to date:	\$26,720	On schedule?	Yes
Available Amount:	\$173,280	ADVANTAGE No.	R0627 19P
Percent complete through 6/30/07	10%	Responsible ATRC Staff: (Project Manager)	Steve Owen

PROBLEM STATEMENT

Accurate, complete and timely traffic data is critical to the effective management of the State's highway system. Limitations in current traffic monitoring abilities are an ongoing problem for ADOT, and for its customers as well, in both urban and rural areas. MAG, PAG, and ADOT's Transportation Planning Division depend on detector data for planning purposes. If this data is not accurate, it may cost the state millions of dollars in federal funding. ADOT now spends about \$50,000 per site to install detection, and another \$1,000 per year to maintain each site. For 250 centerline miles of freeway, ADOT will invest roughly \$25M to install traffic sensors and another \$10M to maintain them over the 20-year life of the Regional Transportation Program.

RESEARCH OBJECTIVES

A number of technologies exist for detecting vehicles and determining volume, occupancy, and speed. Current technologies include buried loops, micro-loops, passive acoustic detectors, radar, and video detection. All have been used with varying degrees of success in different states.

This research will evaluate different non-intrusive technologies for traffic surveillance. The project will perform a state-of-the practice review of current technologies with the potential to more accurately monitor traffic volume, occupancy, and speed. This review will also include a literature search of recent and current research. The results will be specific recommendations in technology, software, and communications, and a conceptual testbed design, that conform to the basic ADOT goals, design constraints, data requirements, and budget limitations.

On this basis, the project will then develop the detailed design of a field test environment and evaluation program. Upon acceptance of the design, this project will support the establishment of the field evaluation testbed site, by others. Based upon this study's earlier recommendations, the most promising detector types will be deployed for an initial field-testing period, and the evaluation results will be documented in an ATRC final report.

EXPECTED IMPLEMENTATION

ADOT's entire freeway management operations mission in the major metropolitan areas is hampered by poor or missing data. The core data goals are impacted, including valid traveler information for the public, as well as valid traffic data for ADOT planning, for FHWA, and for partner agencies such as PAG, MAG, and AZTech. Effective new solutions for urban freeway management systems also will transfer to rural highway operations across the state. The results

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of this research and evaluation program will provide the basis for future planning and design of ADOT's Freeway Management System (FMS). Local corridor testing of field-evaluated systems is a likely initial result of the study. If the tests are successful, then upgrades to FMS segments and to ADOT's rural ITI could follow, as funding allows.

STATUS OF THE RESEARCH

This project was scoped in three phases; the Texas Transportation Institute (TTI) is performing the initial two phases, which include a detection state of the practice study, a conceptual testbed site design, traffic-detector evaluation recommendations, and the detailed site design evolving from the conceptual phase. By mid-2007, the second phase agreement was completed and TTI was initiating the transition from the concept to a full testbed facility design.

As the detailed design nears completion, development will begin on the proposed test site on heavily congested Interstate 10 through downtown Phoenix. The planned evaluation of several candidate detector systems may utilize the resources of both TTI and a local consulting team.

TECHNICAL ADVISORY COMMITTEE (TAC)

S. Nodes (sponsor)	ADOT Technology Group / Traffic Operations Center
R.Gish, G. Jonas, D. Barker,	ADOT Transportation Technology Group
L. Warnick, J. Lovell	
T. Wolfe, J. McGuirk,	Phoenix Maintenance District
C. McClatchey	
G. A. Girgis	ADOT Vision – ITS/FMS Construction
M. Manthey, D. Duffy	ADOT Traffic Engineering Group
J. Garrison, D. Eberline	ADOT Transportation Planning Division
S. Joshua, W. Zhang, L. Luo	Maricopa Association of Governments (MAG)
P. Casertano	Pima Association of Governments (PAG)
B. Dressel	City of Scottsdale
T. Kelley	Pima County DOT
J. Decker	City of Tempe
Cdr. T. Woodward	Arizona Department of Public Safety
A. Hansen	Federal Highway Administration

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SPR-634, A Platform for Evaluating Emergency Evacuation Strategies

Research Agency:	University of Arizona	FY Authorization:	2007
Principal Investigator(s):	Drs Yi-Chang Chiu & Pitu Mirchandani	Contract Date:	03/09/07
Contract Amount:	Pending	Sched. Completion Date:	09/30/08
Program Budget:	\$100,000	Est. Completion Date:	09/30/08
Expenditures to date:	\$5,564	On schedule?	Yes
Available Amount:	\$94,436	ADVANTAGE No.	R0634 19P
Percent complete through 6/30/07	10%	Responsible ATRC Staff: (Project Manager)	Steve Owen

PROBLEM STATEMENT

The importance of transportation resources in emergency planning and response was proven in late 2005, with Hurricanes Katrina and Rita. During these events, deficiencies in the planning and execution of evacuation strategies were apparent. The real scenarios that occurred were far from the anticipated potential scenarios. Moreover, it is clear that existing public agency tools are limited in how well they can support real-time evacuation management.

A more comprehensive resource is needed that includes network and transportation services data and simulation tools to evaluate evacuation strategies and evacuee response. It would be a tool for emergency management personnel to better plan and execute evacuation procedures.

RESEARCH OBJECTIVES

This study will develop a robust platform to create evacuation strategies for Arizona. This resource will evolve through extensive regional data collection, supporting the development of viable simulation tools. The platform will be tested with diverse scenarios, and evacuation strategies will be developed, evaluated, and validated for each scenario. Key resources for the study include a Transportation Research Board web link for transportation security and evacuation research topics, and an FHWA website on emergency operations.

EXPECTED IMPLEMENTATION

This study will develop a platform to analyze and identify the best emergency response and transportation system management strategies for a variety of crisis evacuation scenarios that are directly relevant to Arizona.

The result will be a toolkit for development of operational and effective crisis evacuation plans and management strategies as required by ADOT, and for other partner agencies across the state. It will support internal and joint exercises and planning for critical situations - both those presently anticipated, and those that may evolve in the future.

STATUS OF THE RESEARCH

This project was initiated in April 2007 with a TAC kickoff meeting. The university team reviewed their goals, the work plan, and the state of the practice in multi-scalar real-time adaptive evacuation modeling. Since the initial meeting, TAC partners have furnished several databases to the research team for initially populating the university's evolving MALTA

ITS

simulation platform. Tasks underway by mid-summer include system architecturing, data collection, and evacuation scenario development.

TECHNICAL ADVISORY COMMITTEE (TAC)

S. Nodes (sponsor)	ADOT Technology Group / Traffic Operations Center
B. Tait	ADOT-ITD Emergency Management
B. Scott	Arizona Division of Emergency Management
B. Hahn, F. Saleem	Maricopa County DOT
L. Luo, S. Joshua	Maricopa Association of Governments
G. Thum, P. Casertano	Pima Association of Governments
A. Hansen	Federal Highway Administration

ITS

SPR-635, Improved Efficiency Through Driving-Simulator Training

Research Agency:	Arizona State University	FY Authorization:	2007
Principal Investigator(s):	Dr. Mary Kihl	Contract Date:	02/08/07
Contract Amount:	Pending	Sched. Completion Date:	10/31/07
Program Budget:	\$50,000	Est. Completion Date:	10/31/07
Expenditures to date:	\$0	On schedule?	Yes
Available Amount:	\$50,000	ADVANTAGE No.	R0635 19P
Percent complete through 6/30/07	50%	Responsible ATRC Staff: (Project Manager)	Steve Owen

PROBLEM STATEMENT

ADOT's snowplow truck driving-simulator systems have fuel management training modules, but the potential savings are not yet clear. A current study of the snowplow simulator training will end before longer-term fuel use is known. This project will extend the analysis for another year, to confirm early results and to more fully support future ADOT decisions on the purchase and deployment of additional simulators.

ADOT spent about \$2.4 million on diesel fuel in 2005. The estimated costs savings from fuel management training as reported by other entities vary considerably, from 2.8% to 23%. Even if the low estimate is correct, however, ADOT can save significantly on yearly fuel consumption. This new study will help ADOT to better estimate these benefits and achieve its efficiency goals. Furthermore, ADOT has invested more than \$170,000 in each of the four L3 TransIM VS III driving simulators at Globe, Flagstaff, Holbrook, and Safford.

The literature suggests that "several factors make it difficult to evaluate the effectiveness of simulator training on fuel management." However, by using ADOT's Globe District for a well-controlled pilot study, the impact of simulator training on fuel efficiency and related repair issues can be effectively studied.

RESEARCH OBJECTIVES

This project will use both qualitative and quantitative methods to estimate the potential benefits of simulator driving-skills training on fuel management in terms of cost savings associated with fuel use, and related maintenance and operational factors (such as terrain, transmission types, etc.). It will also address repairs and other less direct costs (driver turnover, etc.), to help determine the best long-term use of existing and future ADOT simulators.

The proposed research involves four phases: (1) Design pilot study, (2) Conduct study, (3) Report findings/recommendations, and (4) Work with ADOT to implement recommendations.

EXPECTED IMPLEMENTATION

As of mid-2007 ADOT has procured four driving-simulator units, one of which will be trailer-mounted. In order to maximize return on investment, ADOT must ensure that each simulator is used effectively. Setting priorities for the simulator requires that ADOT fully understand the benefits of using the simulator to train its equipment operators for improved driving skills, more fuel efficiency, and reduced repairs. This new study will address these issues. In addition, it will include a review of various options for resource ownership and deployment at the district level.

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This research will deliver its findings and recommendations in late 2007, and the project team will work with ADOT to implement recommendations.

STATUS OF THE RESEARCH

This project was initiated in early February 2007 with a TAC kickoff meeting. The university team made a smooth transition from the just-completed SPR-585 project to extend their working relationship with the Globe District training and operations staff, and the TAC.

The project focuses primarily on Globe data as regards fuel efficiency, driveline repairs, and related claims and other cost impacts for the current winter season. Globe was the one ADOT district that was able to train all of its heavy truck operators on the fuel management module of the simulator course, but the few months of data collected for the 585 report were insufficient.

In the early months the project team witnessed driver fuel training, did a driver survey, did plow truck ridealongs for task analysis, and monitored fuel efficiency test runs with Globe drivers on a 120-mile loop. At mid-summer, the winter's records on fuel usage, repairs, work tasks, weather and related factors were being collected for analysis. Further training observation and fuel test runs were planned for late summer, as the basis for final results and recommendations.

TECHNICAL ADVISORY COMMITTEE (TAC)

E. Blankenship (champion),	ADOT - ITD Technical Training
A. Parris	
D. Halachoff (champion),	ADOT Equipment Services Fleet Management
B. Kohn, J. Massie, D. Jenkins	
C. Eyrich	ADOT Equipment Shop – Flagstaff
D. Forstie	ADOT - ITD Operations Group (sponsor)
R. Powers, DE	Globe District Engineer (co-sponsor)
J.A. Noriega	Globe District Training Coordinator
C. Willis	Globe District Shop Supervisor
J. Harper, DE	Flagstaff District Engineer (co-sponsor)
D. Russell	Flagstaff District Maintenance Superintendent
G. Garcia, Jr.	Flagstaff District Training / Safety & Health
D. Johnson	Williams Maintenance (Flagstaff District)
L. Johnson, DE	Holbrook District Engineer
R. Routhier	Holbrook District Maintenance Engineer
R. Gabaldon	Holbrook District Training Coordinator
B. Harmon, DE	Safford District Engineer
T. Engel	Safford District Maintenance Engineer
D. Palmer	Safford District Training Coordinator
C. Eiserman, S. Olson	ADOT Risk Management Section
A. Hansen	Federal Highway Administration

ITS

SPR-643, Evaluation of Yellow Left-Turn Arrow Phasing and Flash Options

Research Agency:	Pending	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	Pending
Program Budget:	\$24,500	Est. Completion Date:	Pending
Expenditures to date:	\$0	On schedule?	N/A
Available Amount:	\$24,500	ADVANTAGE No.	R0643 19P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Steve Owen

PROBLEM STATEMENT

A variety of diverse permissive or protected left-turn signal methods are in use across the US, and in various Arizona cities. However, the many options of signal timing, flash or steady-burn mode, and indicator design (ball, arrow, etc) may cause driver confusion, and may increase the risk for left-turn movements. The Arizona Department of Transportation (ADOT) operates more than 550 traffic signals statewide at highway and city-arterial intersections, many of them heavily congested. There is a need to identify potential improvements in clarity and consistency of the left-turn signal message to drivers.

Because of Arizona's steady population and traffic growth, and the expansion in the number of ADOT-controlled intersections, the risk of left-turn crashes remains high. Some local traffic engineering departments have tested or deployed a variety of left-turn signal concepts, as has also been done in other states. ADOT needs to review and evaluate left-turn signal control practices to identify the most practical and safe approaches. The desired outcome will be more consistent operations, and better compatibility at the local-jurisdiction interface.

RESEARCH OBJECTIVES

This study will identify the most relevant control planning tools, signal head patterns, hardware, and technology resources, and it will produce clear recommendations to achieve ADOT's goals, before consideration of implementing any changes on the State system. The project team will review recent literature including relevant work by NCHRP, and contact selected other agencies on the results of options that they have employed. It will review the current control plans and signal head designs of key agencies, in particular those of ADOT and selected Arizona cities.

A key goal is to assess the current theory and applications of various flashing and steady-burn modes and colors for turn arrows. Initial results *may* call for limited testing of options that relate to ADOT's key criteria. The project will recommend how ADOT can standardize its overall approach, technology, and left-turn signal policies with other local traffic agency partners.

EXPECTED IMPLEMENTATION

Both ADOT and local-agency partners will benefit from the results of this study, especially by the establishment of more consistent protected left-turn signal operations, statewide. Left-turn crashes, one of the most frequent and serious types of accident, would be reduced as drivers adapt to the new, more consistent signal modes.

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The State Traffic Engineer will implement the successful results of this research as policy for ADOT. Initially, ADOT regional traffic groups may do pilot deployments and signal control plan revisions, as budgets permit. Wider adaptation by local partners will be recommended.

STATUS OF THE RESEARCH

This project has not yet been initiated.

TECHNICAL ADVISORY COMMITTEE (TAC)

G. Gentsch, DE (sponsor)	ADOT Tucson District Engineer
R. Karimvand (champion)	Southern Region Traffic Engineer
R. Moeur	ADOT Traffic Engineering
R. Nassi	City of Tucson
M. Manthey	State Traffic Engineer - ADOT
J. Brown	Federal Highway Administration

ITS

SPR-645, Automatic Vehicle Location (AVL) and Maintenance Work Effort Tracking

Research Agency:	Pending	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	Pending
Program Budget:	\$125,000	Est. Completion Date:	9/30/08
Expenditures to date:	\$0	On schedule?	N/A
Available Amount:	\$125,000	ADVANTAGE No.	R0645 18P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Steve Owen

PROBLEM STATEMENT

Reliable communication with ADOT maintenance workers is a key management and safety concern, particularly in winter snowfighting efforts. The primary issues are operator safety, and tracking of crew work efforts for accurate reporting. ADOT must know where snowplows are along their routes, if and when those roads were plowed or treated with chemicals, and, at what rate. Environmental issues are also significant. Field managers must be able to document what, when, and how much anti-icing or de-icing chemical is applied along the State's roadways.

Automatic Vehicle Location (AVL) offers better, more timely data for pre-storm planning and for a prompt reaction to changing storm conditions. AVL can provide better information on road conditions for the media and the public. It can improve roadway de-icer usage, and management of stockpiles and plow equipment wear parts. GPS location data will improve driver safety, and by automating daily work records, can also reduce driver workload and stress, and improve their efficiency. More detailed and accurate AVL data will support ADOT against damage claims, and improve recordkeeping on environmental concerns.

The intent of this pilot AVL deployment is to receive, store, interpret, and utilize hard data in place of the hand-written operator reports from memory for a 12-hour plow shift. This hard data will provide a consistent picture of snowplow activity over the winter across the entire district, and a complete history for each route of the locations, events, and performance.

RESEARCH OBJECTIVES

Up to thirty snowplows across the Globe District will be equipped with AVL data systems as a regional pilot test for the 2007-08 winter, in the first effort to install AVL on all of a District's plow trucks. The system will be used on a variety of routes, to determine the extent, quality, and timeliness of the key plowing data needed for rural operations. It will also show if typical rural Arizona cellular service is sufficient to justify this technology, as tested across Globe District's diverse terrain.

EXPECTED IMPLEMENTATION

This research will determine the operational effectiveness of cellular AVL data systems for rural districts. A positive result will justify and support wider deployment of AVL data systems for Arizona's critical snowplowing operations, as well as for other types of heavy equipment.

STATUS OF THE RESEARCH

This project has not yet been initiated.

ITS

TECHNICAL ADVISORY COMMITTEE (TAC)

J. Miller (champion)	ADOT Globe Maintenance Operations Superintendent
R. Powers (sponsor)	ADOT Globe District Engineer
Globe District Operations Team	All 7 Maintenance Org Supervisors
S. Henson	Globe Maintenance Analyst
C. Willis	Globe Equipment Shop
A. Romero	Show Low Equipment Shop
J. Wakefield, M. O'Malley	Central Fleet Equipment Services
C. Eiserman	ADOT Risk Management
A. Hansen	Federal Highway Administration

ITS

SPR-653, Arizona VII Initiative: Proof of Concept/Operational Testing

Research Agency:	Pending	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	Pending
Program Budget:	\$200,000	Est. Completion Date:	6/30/09
Expenditures to date:	\$0	On schedule?	N/A
Available Amount:	\$200,000	ADVANTAGE No.	R0653 18P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Steve Owen

PROBLEM STATEMENT

Vehicle Infrastructure Integration (VII) is the USDOT initiative to improve safety and mobility through enhanced roadside-to-vehicle and vehicle-to-vehicle communications and real-time information exchanges. Arizona is advanced in applying ITS technologies and in real-time information sharing among public agencies, but our networks are not currently adaptive to actual conditions on the roadways. Non-recurring congestion severely reduces mobility and operational efficiency of the urban area transportation network. Technology provides for adaptive network management, and VII explores how this can be implemented and integrated with legacy systems.

Arizona will research potential VII applications and strategies to support enhanced incident management, and enhanced traffic control through real-time vehicle-to-roadside and vehicle-to-vehicle information sharing. Operations and safety – for incident responders as well as the traveling public - can be enhanced by real-time communications between network management systems and emergency response vehicles.

RESEARCH OBJECTIVES

The Emergency Vehicle focus of the pilot program has led to the "Arizona EVII" working title of this project. Phase I will develop and test potential incident management-specific applications: in-vehicle signing/displays, audible in-vehicle warnings, vehicle-to-roadside interfaces, roadside-to-center applications, and vehicle-to-vehicle communications.

Using outcomes of Phase I, the Phase II effort will test and research the successful applications in a pilot deployment. The Arizona EVII Phase II evaluation will assess functionality of the hardware and software, the human factors/responses, and the viability of the technology applications to support enhanced incident management. The project will demonstrate and identify interoperability requirements between new VII technologies and legacy systems. It is also intended to demonstrate enhanced safety benefits by improving real-time communications with emergency response vehicles, and real-time adaptive traffic management strategies.

EXPECTED IMPLEMENTATION

This study will provide an enhanced means of managing traffic based on real-time conditions, particularly for non-recurring incident congestion. In the future, response agencies will benefit from real-time vehicle information as sent to field devices, and to traffic operations centers. Further outcomes of this Arizona EVII research will include the proof of concept, prototype VII tools, human factors data, and significant inputs to the national VII effort.

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STATUS OF THE RESEARCH

This project has not yet been initiated.

TECHNICAL ADVISORY COMMITTEE (TAC)

S. Nodes (champion)	ADOT-ITD Transportation Technology Group
F. Saleem, M. Scott	Maricopa County DOT
A. Hansen	Federal Highway Administration
<i>*Others TBD</i>	

(with) Program Support Consultants (MCDOT) – Kimley-Horn and Associates

(with) EVII Coalition Vendor Partners: Econolite Systems

Maintenance

Maintenance – PROJECTS

SPR-500, Aggregate Sources for Construction and Maintenance in Northern Arizona

Research Agency:	Prophecy Consulting	FY Authorization:	2000
Principal Investigator(s):	Vi Brown	Contract Date:	7/18/07
Contract Amount:	\$235,254	Original Completion Date:	July 2008
Program Budget:	\$250,000	Estimated Completion Date:	July 2008
Expenditures to date:	\$9,115	Is project on schedule?	Yes
Available Amount	\$240,885	ADVANTAGE No.	R050012P
Percent complete through 06/30/05	4%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

For the greater part of the interstate construction program, the Arizona Department of Transportation (ADOT) maintained the responsibility to locate acceptable aggregate sources for construction purposes. ADOT would locate sources of material, obtain all clearances and permits and perform the geotechnical analysis of the pit composition. At one time, ADOT maintained a database of over 8,000 material pits located around the state. This process made ADOT liable for material acceptability and often times resulted in claims from the contracting industry based upon misrepresentation of the character or quantity of material involved.

In more recent times ADOT turned over the material source issue to the contracting sector. The contractor currently is responsible for locating and obtaining pits for each individual construction project. This makes the contractor entirely responsible for his quality and quantity of material obtained.

Recently, material sources are becoming increasingly more difficult to find and use, even for the private sector. Many of the material sources in northern Arizona are located within reservations and the Indian nations have been less willing to allow access and use.

The lack of material availability is even affecting aggregate sources for maintenance use. There is a need to provide reliable aggregate sources for construction and maintenance activities.

RESEARCH OBJECTIVES

The objective of this research is to identify the aggregate sources available for construction and maintenance in northern Arizona and to determine the means by which these sources will be used.

The following minimum tasks will be performed:

1. Conduct a literature search relevant to available aggregate sources in Arizona.
2. Canvass the construction industry and other governmental agencies to establish additional pit sources and potential options for providing aggregate sources such as regionally located designated sources and or designated locations where materials are transported to or where

Maintenance

large aggregate crushing contracts are established to provide material sources for many projects.

3. Canvass ADOT construction and maintenance personnel for problem identification and potential solutions.
4. Determine the locations/potential locations of all available material sources in northern Arizona for use by the highway community.
5. Prepare a working paper summarizing the recommendations for providing aggregate sources for construction and maintenance purposes in northern Arizona for the next ten years. The working paper will provide all the justification and supplemental information necessary to support the recommendations.
6. Upon approval of the recommendations submitted in Task 5, develop an implementation plan that will provide the material sources necessary for construction and maintenance operations in northern Arizona for the next ten years. The plan will specify each location, the plan for developing the site(s) and any process changes necessary to use the sources.
7. Prepare a final report documenting the efforts of the study and the conclusions and recommendations.
8. Prepare a Research Note in accordance with Arizona Transportation Research Center (ATRC) procedures.
9. Conduct an executive presentation to the Research Council.

EXPECTED IMPLEMENTATION

The results from this research project will establish the aggregate sources for construction and maintenance activities in Northern Arizona.

STATUS OF THE RESEARCH

This project will be piggybacked upon a previous effort by the state land department. Efforts are underway to form a new TAC and begin prosecution of the project.

TECHNICAL ADVISORY COMMITTEE (TAC)

John Lawson	Materials Group, Champion/Sponsor
Doug Forstie	State Engineers Office
Jim Delton	Materials Group
Randy Vuletich	Materials Group
Allan Samuels	Construction Section
Lynn Johnson	Holbrook District
Randy Pair	Holbrook District
Chad Auker	Flagstaff District
Mike Rice	State Land Department
Tom Deitering	FHWA
Stan Robbins	Apache County

Maintenance

SPR-536, Improved Snow Plow Headlight Visibility and Reduced Driver Fatigue

Research Agency:	Best Highway Safety Practices Institute	FY Authorization:	2002
Principal Investigator(s):	Chad Dornsife	Contract Date:	1/11/07
Contract Amount:	\$47,000	Original Completion Date:	January 2008
Program Budget:	\$50,000	Estimated Completion Date:	January 2008
Expenditures to date:	\$2,400	Is project on schedule?	Yes
Available Amount	\$47,600	ADVANTAGE No.	R053614P
Percent complete through 6/30/07	5%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

Plowing snow is very difficult, but very necessary. Poor weather reduces visibility. This problem is further exacerbated by the need to mount headlights higher on the equipment so they shine over the plows. This often results in the plow lights being almost at the operators' eye level, which is the worst condition for reflecting light back into the snowplow driver's eyes, obscuring their vision even more. This headlight position also reduces visibility for on-coming traffic since the headlights are higher than normal. The additional colored beacon lights that are used on plows as warning devices also reflect off of the snow into the operator's eyes. Although these lights are mounted behind the driver, they still reflect off the snow and obscure vision. Other problems that exist during plowing operations are the visibility through the windshield due to fogging over and the effectiveness of the wipers themselves.

An informal survey was conducted in 2005 at a meeting mostly attended by ADOT maintenance staff. Of the 50 to 100 respondents, not one operator felt that snowplow visibility was adequate. This is an alarming statistic since clearing of the roadway is the most significant safety improvement ADOT can make for the traveling public during the winter season.

In addition to the reduced vision caused by these problems, increased driver fatigue is experienced. Since plowing snow is such a difficult event, anything that contributes to additional fatigue should be minimized or eliminated.

This problem was the focus of a recently completed National Cooperative Highway Research Program (NCHRP) study that made recommendations for improvements. ADOT's previous study on Winter Storm Operations also made recommendations to improve plow operations. However, no recommendations to improve lighting configurations have been provided to eliminate the problems described.

RESEARCH OBJECTIVES

The objective of this research is to increase operator visibility and to reduce glare to on coming traffic during plowing operations.

The following tasks, at minimum, will be accomplished:

1. Review recommendations of previous research, other state's practices, and available equipment.

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2. Recommend the necessary equipment and procedures to improve driver visibility and to reduce glare to on-coming traffic. The recommendations should include costs.
3. Purchase the equipment and attachments necessary to retrofit one of ADOT's existing plows with the recommended equipment and demonstrate the visibility improvement through video documentation during inclement weather.
4. Document improvements to worker safety as a result of the installed devices/modified practices. The evaluations should be a before and after study
5. Prepare a final report documenting the research methodologies, findings, and recommendations and conclusions.
6. Prepare an Arizona Transportation Research Center (ATRC) Research Note for distribution.
7. Prepare an executive presentation on the findings to the Research Council.

EXPECTED IMPLEMENTATION

The results of this research would be used to modify ADOT's snowplow fleet.

STATUS OF THE RESEARCH

A former ATRC staff conducted some preliminary work. A prototype light support system has been developed in-house to "boom" lights beyond the plow in front of the plow. The proof of concept work indicated significant advantages to the lighting approach. The durability of the lighting system was not acceptable however. Accelerometers were placed on the plow during dry pavement operation to measure the actual accelerations experienced. A modification to the light fixture attachment will be made for testing in the fall of 04. Since the former ATRC staff that had conducted the work left ADOT, the TAC decided to hire a consultant to continue the project. A consultant should be selected by the end of 2006 to complete the work.

TECHNICAL ADVISORY COMMITTEE (TAC)

Danny Russell	Flagstaff Maintenance, Champion/Sponsor
Kent Link	Flagstaff Maintenance
Carl Eyrich	Flagstaff Equipment Services
Eddie Faultner	Williams Maintenance
Todd Russell	Williams Maintenance
Dean Murguic	Equipment Services
Joel Miller	Globe District
Robert Wilbanks	Holbrook District
David Sattler	Kingman District

Maintenance

SPR-612, Evaluate Effectiveness of Cattle Guards and Fencing

Research Agency:	HDR Engineering, Inc	FY Authorization:	2005
Principal Investigator(s):	Brent Cain / Courtney Reuer	Contract Date:	March 2006
Contract Amount:	\$9,000	Sched. Completion Date:	November 2007
Program Budget:	\$9,000	Est. Completion Date:	November 2007
Expenditures to date:	\$6,680	On schedule?	Yes
Available Amount:	\$2,320	ADVANTAGE No.	R061217P
Percent complete through 6/30/07	74%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

Animal related accidents in Arizona have also drawn concerns economically and in highway safety. ADOT has actively taken actions and measures to reduce Animal related accidents. For example, a research titled “Evaluation of measures to minimize the incidence of wildlife-vehicle collisions and maintain wide life permeability across highways in Arizona, USA” has been conducted to specially minimize the incidence of wildlife-vehicle collisions along State Route 260. Studies have also been conducted extensively in other states. Domestic (horse and cow) animals often find their way in the right of way. Studies show that while the domestic animal accidents represent only a small percentage of the animal-vehicle accidents, they are more severe than wild animal accidents. While studies show that the traditional high and strong fencing and cattle guards have been proven to work there are new measures that have been proposed and studied. The recent studies also include how to most cost-effectively apply various fencing to different locations. With a growth in wildlife and vehicular traffic there is a potential increase in Vehicle-animal accidents. Therefore, there is a need in Arizona to make best use of the existing research results in cattle guards and fencing to reduce Vehicle-animal accidents.

RESEARCH OBJECTIVES

There already exists extensive information regarding this topic, either in documented form or as undocumented experience and practice. The project objectives are (1) to locate and assemble documented information; (2) to conduct a survey among selected states to learn what practice has been used for solving or alleviating the problems; (3) to identify all ongoing research; (4) to learn what problems remain largely unsolved; (5) to recommend practices for solving or alleviating the problem facing ADOT; (6) to organize, evaluate, and document the useful information that is acquired; and (7) to prepare concise, documented reports on the topic.

EXPECTED IMPLEMENTATION

Districts will implement the effective technologies, techniques, and measures recommended in the research.

STATUS OF THE RESEARCH

The project is underway.

Maintenance

TECHNICAL ADVISORY COMMITTEE (TAC)

Dan Williams	Tucson District, Champion
Randy Routhier	Holbrook District, Sponsor
Lonnie Hendrix	Central Maintenance
Cindy Eiserman	Risk Management
Karen King	FHWA

Maintenance

SPR-617, Evaluate Effects of Snowplow and Deicing Chemicals on Rubberized Asphalt Pavements

Research Agency:	Nichols Consulting Engineers, Chtd.	FY Authorization:	2006
Principal Investigator(s):	Rita Leahy	Contract Date:	3/16/07
Contract Amount:	\$116,740	Sched. Completion Date:	March 2008
Program Budget:	\$116,740	Est. Completion Date:	March 2008
Expenditures to date:	0	On schedule?	Yes
Available Amount:	\$116,740	ADVANTAGE No.	R061718P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

The application of de-icing chemicals to roads is a required winter maintenance method in order to maintain traffic safety. However, de-icing chemicals may have potential adverse impact on pavement surface. Most pavement surface damage results from a natural process called the freeze-thaw cycle. The freeze-thaw cycle involves moisture seeping into the cracks and surface pores and freezing. As the moisture changes to ice, it expands which puts stress on surfaces. De-icing chemicals increase the number of freeze-thaw cycles and can also double the rate of expansion during freezing. Weak pavements may crack or pit under this added stress. There is also a question as to whether the chemicals (chlorides and ant-corrosive agents) have an effect on the asphalt and rubber in the rubberized friction course. The chemicals may speed up the natural oxidation process and shorten the pavement life. To avoid pavement damage, using a pure traction aid such as garnet sand, rather than ice melting chemicals may be an option. However, if the maintenance of a clear highway is critical, the risk of surface damage against the potential liability must be considered. In Arizona, almost all the interstate highway pavement and most of the other pavement is surfaced with a rubberized friction course. The impact of the application of de-icing chemicals on rubberized pavements is not fully understood.

RESEARCH OBJECTIVES

The objectives include: (1) using field and laboratory experiments, evaluate the effect of the application of various ice and snow melting chemicals on rubberized pavements; and (2) select the most cost-effective ice and snow melting chemical blends, and application rate and procedure, and other accompanying pavement maintenance strategies for rubberized pavements to meet the goals of both traffic safety and reducing pavement damages related to the application of de-icing

EXPECTED IMPLEMENTATION

District maintenance groups will implement the suggestions regarding applying de-icing chemicals. Materials group can implement the new findings regarding asphalt mix.

STATUS OF THE RESEARCH

The project is not yet underway.

Maintenance

TECHNICAL ADVISORY COMMITTEE (TAC)

Julie Kliewer	Materials Group, Champion
Roy Alvis	Prescott District
Chad Auker	Flagstaff District
Joel Miller	Globe District
Tom Deitering	FHWA

Maintenance

SPR-628, *Evaluation of Maintenance Strategies for ADOT*

Research Agency:	Applied Pavement Technology, Inc.	FY Authorization:	2007
Principal Investigator(s):	David Peshkin	Contract Date:	7/01/07
Contract Amount:	\$100,000	Sched. Completion Date:	December 2008
Program Budget:	\$100,000	Est. Completion Date:	December 2008
Expenditures to date:	0	On schedule?	Yes
Available Amount:	\$100,000	ADVANTAGE No.	R062819P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

ATRC research project SPR-371, *Maintenance Cost Effectiveness Study*, studied several hundred test sections throughout Arizona in three project phases. The study phases are wearing courses (Phase I), surface treatments (Phase II), and sealer-rejuvenators (Phase III). While the project came to an end by 2005, the maintenance strategies applied still have their anticipated remaining life ranging from 4 to 9 years. As a result, some of the goals of the SPR-371 project could not be met. Through further monitoring of those test sections, overall performance of the maintenance strategies related to environment, location, cost, availability etc. can be identified.

RESEARCH OBJECTIVES

1. Review ADOT's current maintenance strategies.
2. Document the materials (binder, admixture, aggregates etc.), gradation and volumetrics etc., used in each of the test treatment of the maintenance research project SPR-371.
3. Fully monitor the test sections constructed under maintenance research project SPR-371.
4. Evaluate performance of the maintenance strategies done in those sections.
5. Identify the effectiveness of maintenance treatments based on a matrix of cost, type of distress, location, constructibility, service life etc.
6. Develop a specific provisional guideline of effective maintenance strategies for ADOT to follow.

EXPECTED IMPLEMENTATION

ADOT maintenance groups will use the resulting information to improve their practices.

STATUS OF THE RESEARCH

The project is underway.

Maintenance

TECHNICAL ADVISORY COMMITTEE (TAC)

Lonnie Hendrix	Central Maintenance, Champion
Jim Delton	Materials Group, Sponsor
Bill Hurguy	Materials Group
Javed Bari	Materials Group
Paul Burch	Materials Group
Doug Forstie	State Engineers Office
Steve Puzas	Safford District
Joel Miller	Globe District
Sharon Gordon	FHWA

Maintenance

SPR-632, Development of Materials for Repairing AR-ACFC Surfaces

Research Agency:	Pending	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	N/A
Program Budget:	\$100,000	Est. Completion Date:	N/A
Expenditures to date:	0	On schedule?	N/A
Available Amount:	\$100,000	ADVANTAGE No.	R063219P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

The predominant surface treatment on ADOT interstate and high volume roadways is an Asphalt-Rubber/Asphalt-Concrete Friction Courses (AR-ACFCs). These open graded materials are somewhat porous and are designed to drain the roadway surface quicker than standard pavements. They provide better wet-weather friction, better stripe delineation and produce less headlight glare. They are also generally quieter than conventional dense graded mixtures. Conventional hot mix or cold mix repair materials are not suitable for these somewhat porous surfaces. Non-porous repair materials behave as a dam within the AR-ACFC, trapping water and accelerating its deterioration. Currently there is no readily available material to repair AR-ACFC surfaces effectively. There is a need to develop and evaluate materials suitable for repairing AR-ACFC surfaces.

RESEARCH OBJECTIVES

The objectives of this task are to develop/find materials for repairing AR-ACFCs and ACFCs and evaluate their acceptability for maintenance repairs.

The following tasks, at minimum, will be accomplished:

1. Review available materials for repairing open graded friction courses.
2. Produce repair materials and construct field test sections for evaluation.
3. Monitor the performance of the materials for three years.
1. Prepare a final report documenting the research methodologies, findings, and recommendations and conclusions.
2. Prepare an Arizona Transportation Research Center (ATRC) Research Note for distribution.
3. Prepare an executive presentation on the findings to the Research Council.

EXPECTED IMPLEMENTATION

If the research is successful, implementation would be immediate. The products developed in this research would be used by ADOT maintenance to repair open graded friction courses.

STATUS OF THE RESEARCH

The project is not yet underway.

Maintenance

TECHNICAL ADVISORY COMMITTEE (TAC)

Greg Gentsch	Tucson District, Champion/Sponsor
Doug Forstie	State Engineers Office
Lonnie Hendrix	Central Maintenance
Jim Delton	Materials Group
Danny Russel	Flagstaff District
Roy Alvis	Prescott District
Julie Kliewer	Materials Group
Tom Deitering	FHWA

Maintenance

SPR-649, Safety Issues Due to Unforeseen Stoppage of High Speed Mainline Traffic

Research Agency:	Pending	FY Authorization:	2008
Principal Investigator(s):	Pending	Contract Date:	NA
Contract Amount:	Pending	Sched. Completion Date:	NA
Program Budget:	\$60,000	Est. Completion Date:	NA
Expenditures to date:	0	On schedule?	NA
Available Amount:	\$60,000	ADVANTAGE No.	R064920P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

As the traffic characteristics change on our interstates, freeways and principal arterials, there are potential safety issues associated with increased traffic volume, congestion, sudden bottleneck, speed differential, non-use or misuse of HOV lane, under-use of alternative routes, etc. The situation becomes worse with highway work zones and unpredictable incidents. The problem is to perform a comprehensive literature review on the best practices to handle these types of situation, analyze a few candidate locations on Arizona highways and develop countermeasures. A possible engineering solution to this problem could be an application of the Intelligent Transportation System (ITS), e.g. using sensors detecting slow-moving or stopped vehicles, Variable Message Signs (VMS) with real-time coordination to provide dynamic and effective motorists' information. The proposed project will look into all effective and feasible solutions addressing the issues.

RESEARCH OBJECTIVES

This proposal encompasses a study to address the safety issues due to unforeseen stoppage of mainline traffic on our highways. The following deliverables are proposed:

- Summary of best practices
- Analysis of candidate locations
- Recommendation plans
- Rough cost estimates

The outcome of this research project will provide a direction to resolve the issues discussed above. Implementation of the recommendation plans will obviously be contingent upon the budget and ADOT approval.

EXPECTED IMPLEMENTATION

The results can be implemented in coordination with the existing ITS applications on ADOT highway systems. Traffic Operations, ITS Group or HES Section will be responsible for this implementation. If this research is quite comprehensive, a minimal follow-up research may be required. Cost of implementation cannot be estimated until the project is completed.

STATUS OF THE RESEARCH

The project is not yet underway.

Maintenance

TECHNICAL ADVISORY COMMITTEE (TAC)

Mike Manthey	Traffic Engineering, Champion/Sponsor
Reed Henry	HES
TBD	Traffic Engineering
TBD	Traffic Operations
Cindy Eiserman	Risk Management
Jeff King	DPS
Karen King	FHWA

Materials and Construction

Materials and Construction – PROJECTS

SPR-396, LTPP and Other Test Section Management and Evaluation

Research Agency:	Arizona Transportation Research Center	FY Authorization:	1995
Principal Investigator(s):	Nichols Consulting	Contract Date:	10/28/2005
Contract Amount:	N/A	Scheduled Completion Date:	6/30/2007
Program Budget:	\$356,000	Estimated Completion Date:	06/30/2009
Expenditures to date:	\$158,000	Is project on schedule?	Yes
Available Amount	\$198,000	ADVANTAGE No.	R039618P
Percent complete through 06/30/06	75 %	Responsible ATRC Staff:	Christ Dimitroplos (Project Manager)

PROBLEM STATEMENT

This project has been re-scoped and represents a consolidation of what was previously SPR 388, 390, 391, 393, and 395. Instead of having multiple projects, the efforts have been consolidated into SPR 396, which previously was just for GPS testing and evaluation. In FY 2006 all data collection was completed. A draft interim report analyzing the data for SPS 1, SPS-4, SPS-6, and SPS-9 is currently being reviewed.

RESEARCH OBJECTIVES

The objective of this project is to ensure the maintenance and evaluation of the ongoing LTPP test sections.

At a minimum, the following tasks will be accomplished:

1. Maintain the signing and pavement markings on all test sections.
2. Conduct filming of distress on test sections, digitize imagery, and conduct analysis of images.
3. Conduct forensic investigations on analysis of test section performance.

EXPECTED IMPLEMENTATION

This project provides for data collection, evaluation, and analysis to support the LTPP program and ADOT's pavement preservation program.

STATUS OF THE RESEARCH

This was an on-going activity monitoring the recently ended service life (15-20 years) of each of the test sections. In June 2007, the Research Council approved an additional \$150,000 to conduct full data testing and analysis of the now out-of-study sections. Evaluation reports on the SPS profiles, and the SPS-5 and SPS-6 experiments are underway by Nichols Consulting, Inc. Interim reports have been submitted for all SPS profiles.

Materials and Construction

TECHNICAL ADVISORY COMMITTEE (TAC)

Doug Forstie	State Engineer's Office
Jim Delton	Materials Group
Julie Kliewer	Materials Group
Paul Burch	Materials Group
Murari M. Pradhan	Regional Materials Engineer
David Burbank	Regional Materials Engineer
Chad Auker	Regional Materials Engineer
Tom Deitering	FHWA

Materials and Construction

SPR-402, Development of Performance Related Specifications for Asphalt Pavements

Research Agency:	Arizona State University	FY Authorization:	1995
Principal Investigator(s):	Dr. Mat Witczak	Contract Date:	11/23/2005
Contract Amount:	N/A	Sched. Completion Date:	3/30/2006
Program Budget:	\$1,019,220	Est. Completion Date:	8/31/2006
Expenditures to date:	\$1,010,574	Is project on schedule?	No
Available Amount	\$8,646	ADVANTAGE No.	R040216P
Percent complete through 06/30/06	95%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

The American Association of State Highway and Transportation Officials (AASHTO) is currently developing a new pavement structural design guide that will be available in draft form in 2000/2001. The new AASHTO pavement structural design guide will be a mechanistic based design procedure. This form of pavement design (i.e. mechanistic design) has not been used by the Arizona Department of Transportation (ADOT) previously. This type of design process is technically more challenging and requires a higher degree of knowledge on the pavement design engineer as well as a more sophisticated approach to materials testing and characterization.

At this same time, the Federal Highway Administration (FHWA) is attempting to complete the Strategic Highway Research Program asphaltic concrete (AC) mixture design process with additional ongoing research. This research will develop a simple performance test and provide models and advanced materials characterization tests.

Both of these studies will significantly alter the methods by which AC structural design and mixture design will be performed. The principal investigator on both of the above referenced research projects is Dr. Matt Witczak a professor at Arizona State University (ASU). To prepare ADOT for implementation of the above referenced research, ADOT and ASU have developed a five-year strategic pavement research effort. The first year of this effort was funded with SPR 402 "Long Term Pavement Performance (LTPP) Superpave Implementation".

RESEARCH OBJECTIVES

The overall objective of this continuation project is to implement a methodology for performance related specifications for asphalt pavements in ADOT. The short-term objective is to leverage the ongoing research activities of AASHTO and the FHWA into Arizona design practice.

The minimum following tasks will be performed:

1. Initiate and develop a fully coordinated and integrated pavement research program and unit consisting of ASU and ADOT personnel to focus on the enhancement of technology and economic aspects related to pavement performance.
2. Integrate the results of the most recent national research work being conducted in the United States on mechanistic pavement design and performance modeling into ADOT practice.
3. Develop an improved asphalt mixture design system that will be based upon the most recent advances formulated by the new Superpave design procedures.
4. Develop an ADOT asphalt cement characterization database.

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5. Develop an ADOT AC stiffness characterization database.
6. Develop an ADOT mixture permanent deformation characterization database.
7. Develop an ADOT fracture characterization database.
8. Develop an ADOT unbound materials permanent deformation database.
9. Develop an ADOT unbound materials module characterization database.
10. Implement the Integrated Climatic model using ADOT environmental conditions.
11. Implement the simple performance AC mixture test in ADOT

EXPECTED IMPLEMENTATION

This research is designed as a five year program intended to fast forward the implementation of the 2002 AASHTO Pavement Design Guide. Implementation of various technologies will occur as the research validates that the technologies are appropriate for Arizona use and implementation into practice.

STATUS OF THE RESEARCH

The project is essentially complete. Awaiting completion of the final report.

TECHNICAL ADVISORY COMMITTEE (TAC)

Don Green	United Metro
Doug Forstie	State Engineers Office
Paul Burch	Materials Group
Julie Nodes	Materials Group
Christ Dimitroplos	ATRC
Bob McGenis	Koch Materials

Materials and Construction

SPR-524, Development of Mix Design Procedures and End Product Specifications for Gap-Graded Asphalt-Rubber Asphalt Concrete

Research Agency:	MACTEC	FY Authorization:	2001
Principal Investigator(s):	Annie Stonex	Contract Date:	04/04/03
Contract Amount:	\$103,110	Sched. Completion Date:	N/A
Program Budget:	\$175,000	Est. Completion Date:	10/30/06
Expenditures to date:	\$152,140	Is project on schedule?	No
Available Amount	\$22,860	ADVANTAGE No.	R052413P
Percent complete through 06/30/05	95%	Responsible ATRC Staff:	Christ Dimitroplos (Project Manager)

PROBLEM STATEMENT

Traditionally, mix designs for gap-graded, asphalt-rubber, asphalt concrete (AR-AC) have been performed by the Arizona Department of Transportation (ADOT) staff using experience and judgment. Test criteria and specifications have not evolved to the point that mix design activities can be out-sourced. This results in significant reliance on personal judgment and experience. This also prevents standardization and proper performance evaluation.

ADOT currently uses recipe or method type specifications for AR-AC construction. The method specifications have evolved with time and represent the collective experience and knowledge of the agency. However, this experience is difficult to transfer and improve.

In the early 1990's, the Federal Highway Administration (FHWA) formed a pooled fund study to develop mix design procedures and specifications for asphalt-rubber asphalt concrete mixtures. Unfortunately, prior to completion, this study was terminated without producing these products. There is a need to standardize mix design procedures for AR-AC. This will allow outsourcing of the mix designs, standardization of the procedures, more contractor responsibility in achieving a quality product, and better performance measurements.

RESEARCH OBJECTIVES

The objective of this research is to develop mix design procedures for designing and specifying AR-AC mixtures in construction.

The minimum following tasks will be performed:

1. Review ADOT's Current AR-AC Mix Design Procedures and Recommend Improvements
2. Develop Procedures for Using the SHRP Gyrotory Compaction/Design Method for AR-AC Mix Designs
3. Compare Results of a Minimum of Three Mixes (Representative of different aggregate sources) Using Each of the Two Design Methods for each of the binder types (i.e. Type 1 and Type 2).
4. Conduct a Workshop to Present the Findings of the Above Comparison to Industry, Accredited ADOT labs and ADOT for Comment and Discussion
5. Based on the Results of the Testing and the Comments from the Workshop, ADOT will Select the Preferred Mix Design Procedure
6. Using the Selected Mix Design Method, Conduct Round Robin Testing with a Minimum of Three ADOT Accredited Labs and the Central Materials Laboratory

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7. Conduct a Workshop to Present the Findings of the Above Comparison to Industry, Accredited ADOT labs and ADOT for Comment and Discussion
8. Prepare a recommended Arizona Test Method for Conducting AR-AC Mix Design. The procedures should be prepared in accordance with the standard test method format used by ADOT.
9. Prepare a Final Report documenting the effort and summarizing the results, conclusions, and findings

Prepare a Research Note

EXPECTED IMPLEMENTATION

The project has revised the Arizona 816 specifications.

STATUS OF THE RESEARCH

Revised specifications have been prepared. Round robin testing with contractor and consultant laboratories has been completed. A draft final report is currently being reviewed.

TECHNICAL ADVISORY COMMITTEE (TAC)

Larry Ilg	Materials Group
George Way	Retired
Julie Nodes	Materials Group
Bob McGenis	Koch Materials
Dan Simpson	Materials Group
Christ Dimitroplos	ATRC

Materials and Construction

SPR-574, Use of NDT Equipment for Construction Quality Control of Hot Mix Asphalt Pavements

Research Agency:	University of Texas at El Paso	FY Authorization:	2004
Principal Investigator(s):	Dr. Soheil Nazarian	Contract Date:	09/22/2004
Contract Amount:	\$134,781	Sched. Completion Date:	N/A
Program Budget:	\$135,000	Est. Completion Date:	10/2006
Expenditures to date:	\$132,576	Is project on schedule?	No
Available Amount	\$2,424	ADVANTAGE No.	R057416P
Percent complete through 06/30/03	95%	Responsible ATRC Staff:	Christ Dimitroplos (Project Manager)

PROBLEM STATEMENT

The new AASTHO 2002 Pavement Design Guide will use a mechanistic-empirical design procedure. This is a completely new form of pavement design compared to previous AASHTO design procedures. Use of this type of approach requires knowledge regarding the modulus, thickness, and poisons ratio of each layer.

Unfortunately, the current construction specifications are not based on these engineering properties. To successfully implement any mechanistic pavement design procedure and to move towards performance-related specifications, it is essential to develop tools that can measure the modulus of each layer.

There is a need evaluate tools that measure modulus and can be combined with results from laboratory and field tests and quality control during construction. To attain a goal of performance related specifications it will be necessary to unify design methodologies to the construction quality control.

Currently there is seismic based equipment that can be readily used in the laboratory for determining the modulus during the mix design stage and then used in the field to measure the as-constructed pavement modulus. These tests can be performed in two to three minutes and are completely non-destructive. They do not requiring coring of the materials nor any special fabrication in the lab beyond what is normally done during the design procedure.

RESEARCH OBJECTIVES

The research objective is to develop a pilot program similar to what the Texas DOT is doing for evaluating the use of seismic equipment for construction quality control of hot mix asphalt concrete pavements.

EXPECTED IMPLEMENTATION

If successful, implementation would require purchasing equipment

STATUS OF THE RESEARCH

The project is underway with all testing having been completed. A draft final report is currently being reviewed.

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TECHNICAL ADVISORY COMMITTEE (TAC)

Chad Auken	Flagstaff Regional Materials
Scott Weinland	Prescott Regional Materials
David Burbank	Tucson District
Christ Dimitroplos	ATRC

Materials and Construction

SPR-575, Concrete Aggregate Durability Study

Research Agency:	Applied Pavement Technology	FY Authorization:	2004
Principal Investigator(s):	David Peshkin	Contract Date:	05/03/2004
Contract Amount:	Pending	Sched. Completion Date:	10/30/2005
Program Budget:	\$37,000	Est. Completion Date:	3/30/2008
Expenditures to date:	\$17,006	Is project on schedule?	No
Available Amount	\$19,994	ADVANTAGE No.	R057516P
Percent complete through 06/30/05	70%	Responsible ATRC Staff:	Christ Dimitroplos (Project Manager)

PROBLEM STATEMENT

The durability of concrete aggregate has long been a problem in the transportation community. In particular, Alkali-Silica Reactivity (ASR) and Sulfate attack have been the two predominant problems associated with long-term concrete durability. Although considered an issue in surrounding states, this has not been considered a serious problem for structures or bridges in Arizona. Unfortunately, these problems typically take many years to manifest themselves and once detected, corrective action is often times difficult to undertake. So prevention is the best solution.

ASR and sulfate attack, although different distress mechanisms, occur as a result of an interaction between the environment and the concrete. Both distresses cause expansion within the hardened concrete resulting in cracking of the concrete.

A recent study on a major airfield in Arizona determined that significant alkali-silica reaction had occurred in the 14-year old concrete pavement. This suggests that this may be more of a concern than previously believed. This, coupled with the fact that it is an issue in surrounding states with similar geological sources, suggests that this needs further research.

RESEARCH OBJECTIVES

The objective of this research would be to review the available knowledge regarding aggregate problems in Arizona and the surrounding states. The minimum following tasks would be performed:

Conduct Literature Search

Canvass the industry and agencies for published and unpublished experience

Review specifications used in Arizona and surrounding states for mitigating the impact of ASR and Sulfate.

Prepare a report documenting the findings of the previous tasks and identifying any needed specification changes to ADOT's current concrete specifications.

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EXPECTED IMPLEMENTATION

The product of this effort would be a report detailing the available information on aggregate performance in Arizona and surrounding states.

STATUS OF THE RESEARCH

The project was just awarded.

TECHNICAL ADVISORY COMMITTEE (TAC)

Christ Dimitroplos, ADOT-ATRC

Jeff Hearne, Salt River Materials Group

Robert Barkley, Hanson Materials

David Burbank, ADOT-Materials

Scott Weinland, ADOT-Materials

Murari Pradhan, ADOT- Materials

Aryan Lirange, FHWA

Tom Deitering, FHWA

Materials and Construction

SPR-577, Pavement Noise Study

Research Agency:	Illingworth and Rodkin	FY Authorization:	2004
Principal Investigator(s):	Paul Donovan	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	9/30/2010
Program Budget:	\$99,000 (FY2008) (\$657,000 total *)	Est. Completion Date:	9/30/2010
Expenditures to date:	\$0	Is project on schedule?	Yes
Available Amount	\$97,000	Advantage No.	R057717P
Percent complete through 06/30/07	50%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

* See Table in Status of Research Heading

PROBLEM STATEMENT

Historically, noise mitigation measures used in the U.S. transportation industry have included use of barriers, walls, and separation (e.g., distance). These methods have been the only acceptable solutions for federally funded projects. Quiet pavements can also be used to mitigate noise but are not currently permitted because the Federal Highway Administration (FHWA) does not view them as a permanent solution.

In Arizona, like other states, berms and walls are the primary noise mitigation measures in the urban corridors. In April 2003, ADOT received approval from FHWA to allow the use of pavement surface type as a noise mitigation strategy. This approval allowed the use of Asphalt Rubber Friction Course (ARFC) overlays as a noise mitigation strategy when used on existing and newly constructed concrete pavements. Where this surfacing is used, ADOT receives a four-decibel reduction for the design of walls and berms. This credit equates to a six to eight foot reduction in wall or barrier height. Perhaps a more meaningful analogy is that if just a three-decibel reduction were achieved through the use of a quiet pavement, it would have a noise impact of about half of the actual traffic volume.

The FHWA approval was granted with the condition that Arizona be a pilot program, with specific research objectives and requirements. The required research is intended to validate the efficacy of using ARFC as a noise mitigation strategy. Since the FHWA was concerned that a pavement solution is not a permanent solution, they requested a pilot program to study the long-term performance of the ARFC overlay. ADOT committed to a long-range study for up to 10 years, the estimated minimum life cycle of the ARFC pavement.

The ADOT Intermodal Transportation Division (ITD) is currently conducting studies of Type 2 (wayside noise measurement) sites. The ITD studies will complement this research, which focuses on Type 1 (source noise) and Type 3 (research grade) sites.

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RESEARCH OBJECTIVES

The objective of the research is to measure and compare noise generated from different pavement types over time. The effects of pavement design and pavement age will be monitored as they affect noise generation from vehicle traffic.

EXPECTED IMPLEMENTATION

The results of the research will be used in the design of future road construction projects.

STATUS OF THE RESEARCH

A Joint Project Agreement (JPA) with the Arizona State University (ASU) Materials Group and a JPA with the ASU Environmental Group are complete. A JPA with the Federal Highway Administration Volpe Center is also complete. The table below shows funding in the corresponding fiscal years:

SPR Fund Source	FY 2004	FY 2005	FY 2008	FY 2010	Totals
Part I (Planning)	\$364,000	-	-	-	\$364,000
Part II (Research)	-	\$99,000	\$97,000	\$97,000	\$293,000
Program Total					\$ 657,000

TECHNICAL ADVISORY COMMITTEE (TAC)

A TAC is being developed.

Materials and Construction

SPR-590, Performance Related Pay Factors for Asphalt Concrete

Research Agency:	Arizona State University	FY Authorization:	2005
Principal Investigator(s):	Dr. Matt Witczak	Contract Date:	03/08/ 2005
Contract Amount:	\$50,000	Sched. Completion Date:	03/08/ 2006
Program Budget:	\$50,000	Est. Completion Date:	10/27/ 2006
Expenditures to date:	\$50,000	Is project on schedule?	Yes
Available Amount	\$0	ADVANTAGE No.	R059017P
Percent complete through 06/30/05	95%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

Currently, ADOT accepts asphalt concrete production based on ten different quality factors. These include: sand equivalent, fractured coarse aggregate particles, uncompacted void content (special mix), material spread, gradation, asphalt cement content, effective voids, stability, compaction, and smoothness.

Of these ten, four are used to determine the mixture-properties and compaction pay factor. They are gradation, asphalt cement content, effective voids, and compaction. The mixture property and compaction pay factor is used to pay the contractor for each ton of asphalt produced on the project. The purpose of the mixture pay factor is to determine payment, based upon on the percent of product within a specified tolerance. This allows payment to be based upon mixture quality. That is, the higher the quality the higher resulting payment.

The mixture property and compaction pay factors were largely developed on experience and judgment and on production equipment capability. The linkage between these pay factors and pavement performance and pavement design is currently not known.

It would be very beneficial to have pay factors that are based upon actual pavement performance and design procedures. The recently completed NCHRP 2002 Pavement Analysis tool provides the capability to evaluate the effect of these mixture characteristics on pavement design and performance. Therefore, rational pay factors could be determined based upon actual design conditions and attendant pavement performance.

RESEARCH OBJECTIVES

The objective of this research is to develop new pay factors for inclusion into ADOT's specifications based upon analysis conducted using the NCHRP 2002 Pavement Analysis Tool. Sensitivity analysis will be conducted for each of the relevant mixture and compaction properties to determine their effect on pavement performance.

EXPECTED IMPLEMENTATION

The results of this research should be used to replace the pay factors shown in section 416 of the standard specifications.

Materials and Construction

STATUS OF THE RESEARCH

The project research has been completed. A draft final report is currently being reviewed.

TECHNICAL ADVISORY COMMITTEE (TAC)

Jim Delton	Materials Group
Julie Nodes	Materials Group
Paul Burch	Materials Group
Javed Bari	Materials Group
Christ Dimitroplos	ATRC
John Shi	MCDOT-Materials
Bob McGennis	Holly Asphalt

Materials and Construction

SPR-605, *Investigations of Environmental Effects on Freeway Acoustics*

Research Agency:	Arizona State University	FY Authorization:	2006
Principal Investigator(s):	Dr. Joe Fernando	Contract Date:	05/04/2006
Contract Amount:	\$90,000	Sched. Completion Date:	05/04/2007
Program Budget:	\$90,000	Est. Completion Date:	05/04/2008
Expenditures to date:	\$64,795	Is project on schedule?	Yes
Available Amount	\$25,205	ADVANTAGE No.	R060518P
Percent complete through 06/30/05	30%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

In April of 2003, ADOT received approval from the FHWA to allow the use of pavement surface type as a noise mitigation strategy. This was granted with the condition that Arizona would conduct a pilot program related to this strategy. A research program was developed to validate the efficacy of using Asphalt Rubber Friction Courses (ARFC) as a noise mitigation strategy. ADOT has begun to monitor four sites across the Phoenix Metropolitan area over a ten-year period to evaluate the effectiveness of ARFC. Recent experiences, however, suggest that traditional noise abatement approaches (e.g. the use of walls) can be defeated by environmental conditions. In the last year, researchers at Arizona State University helped ADOT to monitor environmental conditions associated with acoustic monitoring. In the first (completed) phase, the effects of winds on noise propagation were studied. However, the effects of inversions have not been studied, although they are known to be important; and this will be focus of the proposed work.

RESEARCH OBJECTIVES

In order to understand the influence of stability (inversion) conditions on sound propagation, we will conduct environmental monitoring, concurrent with ADOT acoustic monitoring, under different stability conditions -- during the night or early in the morning, before inversion breakup and during the afternoon during the unstable conditions. Detailed profiles of wind speed and temperature will be obtained using a SODAR (Sound Detection And Ranging) system and its RASS (Radio Acoustic Sounding System) extension. The SODAR remotely sense the wind speed and turbulence statistics profiles in the lower atmosphere (15-1000m). RASS provides the temperature and sound speed profiles (both instruments are available for the ASU group). If surface measurements are needed (< 15m), tethered balloons can be employed. The deliverables of the project are: (i) All temperature, velocity and humidity data in the required forms; (ii) Plots showing the effects of inversions on sound propagation – a manual of results; (iii) Analysis of results; (iv) Final report detailing the procedure, uncertainties, analysis, results and inferences.

EXPECTED IMPLEMENTATION

The results will be melded with ADOT sound monitoring data.

STATUS OF THE RESEARCH

The project is underway.

Materials and Construction

TECHNICAL ADVISORY COMMITTEE (TAC)

Christ Dimitroplos	ATRC; M&C Project Manager; Champion;
Larry Scofield	AZ Concrete Pavement Association (ACPA);
Tom Kombe	ATRC, Environmental Project Manager;
Fred Garcia	ADOT, Environmental Group
Hugh Saurenman	ATS Consulting

Materials and Construction

SPR-606, Implementation of the Mechanistic-Empirical (M-E) Design Guide for Arizona

Research Agency:	Pending	FY Authorization:	2006
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:		Sched. Completion Date:	Pending
Program Budget:	\$350,000	Est. Completion Date:	Pending
Expenditures to date:	\$0	Is project on schedule?	Yes
Available Amount	\$350,000	ADVANTAGE No.	R060618P
Percent complete through 06/30/05	0%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

To complete the final phase of current Project SPR-402: Implementation of the Mechanistic-Empirical Design Guide for Arizona.

Task 1- Accurately calibrate the pavement performance models to local field conditions.

Task 2 - How to implement the Mechanistic-Empirical Design Guide for pavement design and performance prediction in Arizona.

Task 3- Develop a framework for performance related specifications for Arizona.

RESEARCH OBJECTIVES

To calibrate pavement performance models to local conditions using Arizona field data. The result will enable ADOT to utilize the M-E Design Guide and develop a framework for Pavement Performance related specifications.

EXPECTED IMPLEMENTATION

The overall assessment of the utility of the Mechanistic Empirical Design Guide calibrated for Arizona materials and conditions. Framework for pavement performance related specifications for Arizona.

STATUS OF THE RESEARCH

The project has not begun.

TECHNICAL ADVISORY COMMITTEE (TAC)

Jim Delton ADOT Materials
Julie Nodes ADOT Materials
Paul Burch ADOT Materials
Bill Hurguy ADOT Materials
Christ Dimitroplos ATRC,
Tom Deitering FHWA
Private Industry.

Materials and Construction

SPR-608, Development of Rational Pay Factors Based on Concrete Compressive Strength Data

Research Agency:	Arizona State University	FY Authorization:	2006
Principal Investigator(s):	Dr. Barzin Mobasher	Contract Date:	Pending
Contract Amount:	\$14,000	Sched. Completion Date:	Pending
Program Budget:	\$14,000	Est. Completion Date:	Pending
Expenditures to date:	\$14,000	Is project on schedule?	Yes
Available Amount	0	ADVANTAGE No.	R060618P
Percent complete through 06/30/07	95%	Responsible ATRC Staff:	Christ Dimitroplos (Project Manager)

PROBLEM STATEMENT

Concrete strength is one of the major parameters used in the acceptance of a concrete supplied to the Arizona Department of Transportation (ADOT). The purpose of this research project is to compile a set of guidelines used by various transportation agencies and the Federal Highway Administration (FHWA) with respect to acceptance criteria and the use of strength data in the determination of pay factors. The research team will evaluate the applicability of those procedures in consideration of current and proposed ADOT standards.

This document will address a variety of issues that may create the potential for testing cores vs. cast specimens, flexural samples, maturity, and inter-strength relationship between flexural and compressive strength established for the approved mix design (prior to construction) using project-approved aggregates, cement, and admixtures.

The research will focus on obtaining information related to these processes, as well as identifying the typical standard deviations associated with the different strength sampling methods. There are three major tasks identified:

Phase 1 – Evaluation of acceptance criteria

Phase 2 – Evaluation of penalty factors

Phase 3 – Applicability of the acceptance criteria and penalty factors for the use of High performance concrete and high fly ash mixtures.

RESEARCH OBJECTIVES

1. Conducting a state of the art report of what other states are using as a means of acceptance and pay factor determination using concrete property data.
2. Establishment of clear target values (means and standard deviations) that define the pavement quality for which the State Highway Agency is willing to pay 100 percent of the contractor bid price.
3. Provide a straightforward method for determining rational pay adjustments (incentives and disincentives) that are applied when a higher or lower level of quality (as compared to the chosen acceptance quality characteristics (AQC) target values).
4. Investigation of applicability of new software codes which, are used to make potential contractors fully aware of the pay adjustments prior to bidding a project. These include utilization PaveSpec 2.0 software to evaluate the consequences and risks of providing different levels of quality and the risks involved in sampling and testing.

Materials and Construction

5. Evaluation of the applicability of the test methods to concrete materials with properties different than the conventional concrete materials (i.e., high fly ash, high strength, permeability criteria, etc.)

EXPECTED IMPLEMENTATION

The research will result in information that could be used to improve the quality of concrete construction in the State of Arizona.

STATUS OF THE RESEARCH

The project final report is being edited.

TECHNICAL ADVISORY COMMITTEE (TAC)

Jim Delton	ADOT, Materials Group
Scott Weinland	ADOT, Regional Materials
Chad Auker	ADOT, Regional Materials
John Ivanov	ADOT, Materials Group
Robert Barkley	Hansen Materials,
Pat Nealio	Lehigh Southwest Cement

Materials and Construction

SPR-630, Critical Review of ADOT's Hot Mix Asphalt Specifications

Research Agency:	Pending	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	Pending
Program Budget:	\$69,000	Est. Completion Date:	Pending
Expenditures to date:	\$ 0	On schedule?	
Available Amount:	\$69,000	ADVANTAGE No.	R063019P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

The Hot Mix Asphalt (HMA) industry has undergone significant changes in recent years. Changes include technological advancements in the equipment for the production and placement of HMA; changes in material availability; increased environmental regulation; and, changes in mix design criteria and procedures. ADOT's HMA specifications have not always kept pace with these changes and may potentially include requirements that increase the cost of HMA without any improvement in quality. Specification conformance data collected by the Construction Operations Group indicate very low conformance with some specification provisions, which may be a result of specifications that need revision.

RESEARCH OBJECTIVES

1. Review the state of the industry in Arizona with a focus on equipment and technologies currently being used or being considered for use in the production and placement of HMA.
2. Review the Construction Operations Groups specification conformance history for HMA and make recommendations on the probable cause of low conformance items (for example the specification needs to be revised, the specification needs to be better enforced).
3. Prepare a critical review of relevant ADOT HMA Specifications (Chapters 403, 406, 407, 409, 411, 413, 414, 415, 416, and 417) especially as they relate to equipment requirements. Recommend HMA specification changes.

EXPECTED IMPLEMENTATION

Reduction in disputes related to HMA specifications. The results of this research should also lead to improved conformance with HMA specifications.

STATUS OF THE RESEARCH

The Project has just begun.

TECHNICAL ADVISORY COMMITTEE (TAC)

Chad Auken – ADOT
Paul Burch – ADOT Materials
James Carusone – Hanson Materials
Jim Delton – ADOT Materials
Jon Epps – Granite Construction
Julie Gadsby – ADOT

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Adrian Green – Vulcan Materials

Brian Gallimore – Markham Contracting

Bill Humphrey - ADOT HDR

Tom Kennedy – FNF Construction

Julie Kliewer – ADOT – Project Sponsor

Amanda McGennis – AGC – Project Champion

Bob McGennis – Holly Asphalt

Tom Deitering - FHWA

Sharon Gordon - FHWA

Materials and Construction

SPR-631, Evaluate Warm Mix Technology for use in Asphalt Rubber – Asphaltic Concrete Friction Courses (AR-ACFC)

Research Agency:	Pending	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	Pending
Program Budget:	\$150,000	Est. Completion Date:	N/A
Expenditures to date:	\$0	On schedule?	N/A
Available Amount:	\$150,000	ADVANTAGE No.	R063119P
Percent complete through 6/30/07	0	Responsible ATRC Staff:	Christ Dimitroplos (Project Manager)

PROBLEM STATEMENT

European countries are using technologies that allow a reduction in the temperatures at which asphalt mixes are produced and placed. These technologies have been labeled Warm Mix Asphalt (WMA). The immediate benefit to producing WMA is the reduction in energy consumption required by burning fuels to heat traditional hot mix asphalt (HMA) to temperatures in excess of 300° F at the production plant. With the decreased production temperature comes the additional benefit of reduced emissions from burning fuels, fumes, and odors generated at the plant and the paving site. The technology allows the production of WMA by reducing the viscosity of the asphalt binder at a given temperature. This reduced viscosity allows the aggregate to be fully coated at a lower temperature than what is traditionally required in HMA production. There have been a number of demonstration projects in the US with a variety of mixes and binders, but none with asphalt rubber.

RESEARCH OBJECTIVES

Conduct a two-phase project to evaluate the applicability of warm mix asphalt technology to ADOT's AR-ACFC mixes.

The first phase would be principally a laboratory evaluation and review of relevant literature designed to answer the following questions:

Are the existing WMA technologies compatible with the asphalt rubber binders used in ADOT's AR-ACFC mixes?

How does ADOT's design procedure for AR-ACFC mixtures need to be modified to accommodate WMA technologies?

The second phase would be primarily a field trial with the following research objectives:

- Characterize (quantify) the potential plant production / mix lay-down savings that can be generated by using WMA technologies in AR-ACFC (e.g. energy cost reduction, reduced emissions, etc.)
- Characterize the impact of incorporation WMA technologies into AR-ACFC mixes on the surface characteristics of the mix (e.g. noise reduction capabilities, frictional characteristics, and smoothness)
- Evaluate the potential for extension of the paving window for AR-ACFC resulting from reduced paving temperatures (e.g. minimum surface temperature, paving season)

Materials and Construction

EXPECTED IMPLEMENTATION

This research has the significant potential to reduce the plant production and placement costs due to decreases in energy costs. Materials Group will implement the findings in the form of revised specifications and test methods on future projects. Materials Group will implement any recommended changes to the AR-ACFC paving window (temperature and season).

STATUS OF THE RESEARCH

The Project has not yet begun.

TECHNICAL ADVISORY COMMITTEE (TAC)

The TAC has not been assigned.

Materials and Construction

SPR-633, Economical Concrete Mix Designs Utilizing Blended Cements, Performance Based Specifications, and Rational Pay Factors

Research Agency:	Pending	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	Pending
Program Budget:	\$120,000	Est. Completion Date:	N/A
Expenditures to date:	\$0	On schedule?	N/A
Available Amount:	\$120,000	ADVANTAGE No.	R063319P
Percent complete through 6/30/07	0	Responsible ATRC Staff:	Christ Dimitroplos (Project Manager)

PROBLEM STATEMENT

There is a need to contain the escalating costs of construction projects through the use of economical concrete materials and rational acceptance criteria. This is a proposal to increase competitiveness among project bidders by improving the procedures for materials selection, specifications, and also pay factors for contract administration. A preliminary study conducted for joint ADOT/ARPA committee has indicated that there are significant potential cost savings through the reduction of minimum specified cement content in various grades of concrete. Such reductions however must be accomplished so that the performance of final product is not jeopardized. This project will utilize and evaluate recent advances in performance enhancing mineral admixtures and supplementary cementitious materials, in addition to QC parameters used for specification and acceptance criteria in order to develop economical concrete mixtures.

RESEARCH OBJECTIVES

Promote better quality and economics of using concrete materials by focusing on:

1. Mix design formulation based on economy, superior performance, quality control, and durability.
2. Better utilization of mineral admixtures such as flyash through reducing the minimum cement requirements for 2500 psi and 3000 psi concrete mixtures.
3. Evaluation of the acceptance criteria and pay factor adjustment methods based on a bonus/penalty factors in improving quality control and specification procedures.

EXPECTED IMPLEMENTATION

Results can improve the quality of concrete construction in the State of Arizona while saving millions of dollars in construction costs. Historical ADOT data will be evaluated and calibrated against the proposed models that will be developed in this program. Special provisions will be developed and presented to the ADOT materials group. Specifications for new classes of concrete and their associated pay factors will be chosen. Testing and evaluation protocol for field trials as a follow up to this study will be identified.

STATUS OF THE RESEARCH

The Project has not begun

TECHNICAL ADVISORY COMMITTEE (TAC)

Not Assigned.

Planning and Administration

Planning and Administration – PROJECTS

SPR-534, *Digital Signatures*

Research Agency:	Pending	FY Authorization:	2002
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	12/31/06
Program Budget:	\$85,000	Estimated Completion Date:	5/31/08
Expenditures to date:	\$70,971	On schedule?	No
Available Amount	\$14,029	ADVANTAGE No.	R053414P
Percent complete through 6/30/07	60%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

The Arizona Department of Transportation (ADOT) wishes to do more electronic transactions (electronic bidding, procurement, other Motor Vehicle Division transactions, etc.). Many of these transactions require a signature in order to prove a particular person signed a document. Without an electronic means to prove that a particular person or business approved the transaction, these electronic transactions are not possible. This adversely affects the Arizona Department of Transportation by precluding these transactions from being done electronically.

Electronic commerce relies on secure communication between two or more trusting parties. Digital signatures are a necessary component for electronically completing certain transactions. With the volume of electronic commerce and business-to-business transactions skyrocketing, the acceptance of digital signatures is more a question of “when” rather than “if.”

But what exactly will a digital signature look like? While most people might imagine scribbling with little electronic pens on an interactive notepad, digital signatures will, for the foreseeable future, remain far more arcane – and not entirely intuitive. For now, a signature is likely to be a simple bit of encryption embedded in one’s own personal computer that tells other computers that a request for a commercial transaction over the Internet is coming from one’s computer.

Digital signatures ensure a higher level of security and privacy for electronic messages or transactions. Using encryption algorithms, the sender encodes and then “signs” his message, and the receiver can only decode and read it with a corresponding secret code, or “key.” The signature lets the receiver know the message hasn’t been tampered with or forged. Many observers feel that adoption of such schemes, coupled with strong encryption, is necessary for mass use of the Internet for electronic commerce.

RESEARCH OBJECTIVES

1. Prepare a comprehensive study of all the areas within ADOT that digital signatures would help it do business electronically.
2. Propose a technical architecture along with plans for a pilot implementation

Planning and Administration

EXPECTED IMPLEMENTATION

The estimated implementation cost for a full deployment will be determined by the research project. The Information Technology Group will be the ultimate process owner.

STATUS OF THE RESEARCH

The researcher has defaulted. A new one will need to be hired.

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor & Champion: Joe Throckmorton, ITG

FHWA: Vicki Tsutsumida

ATRC: John Semmens

Planning and Administration

SPR-535, Commercial Vehicle Information Systems Network (CVISN) Safety Information Exchange Needs Assessment for the Nogales Port-of-Entry

Phase 1

Research Agency:	Booz Allen Hamilton	FY Authorization:	2005
Principal Investigator(s):	Taso Zografos	Contract Date:	07/26/02
Contract Amount:	\$145,000	Sched. Completion Date:	12/31/03
Program Budget:	\$145,000	Actual Completion Date:	05/31/04
Expenditures to date:	\$145,000	On schedule?	Yes
Available Amount:	0	ADVANTAGE No.	R053517P
Percent complete through 6/30/07	100% (phase 1)	Responsible ATRC Staff: (Project Manager)	John Semmens

Phase 2

Research Agency:	Data Methods	FY Authorization:	2006
Principal Investigator(s):	Robert Done	Contract Date:	11/03/04
Contract Amount:	\$14,820	Sched. Completion Date:	12/31/07
Program Budget:	\$240,458	Estimated Completion Date:	12/31/07
Expenditures to date:	\$98,058	On schedule?	Yes
Available Amount:	\$142,400	ADVANTAGE No.	R053518P
Percent complete through 6/30/07	50% (phase 2)	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Various federal and state motor carrier safety information systems are now available, but are not installed nor being used at the Nogales Cargo Port. This hampers the ability for all commercial vehicle safety inspectors to capture, communicate and collect data pertinent to vehicles and drivers they are examining. The inability of truck inspectors to have immediate access to required records may lead to potential accidents or allow problem drivers to operate vehicles.

The state and federal governments are developing a multi-million dollar inspection facility at Nogales. The lack of timely vehicle and driver information will have an impact on the facility operating at full potential.

A Commercial Vehicle Information Systems Network (CVISN) will provide Arizona and federal truck inspectors with an excellent means to use available technology to obtain and exchange driver and vehicle records, both with Mexican and US authorities, especially as they relate to Motor Carrier Safety and crash history. A Commercial Vehicle Information Systems Network is another smart technology enhancement that will make easier law enforcement's job of making highways safer for the motoring public and preserving the transportation infrastructure.

RESEARCH OBJECTIVE

Evaluate the specific needs in terms of a safety information exchange system under the umbrella of a Commercial Vehicle Information Systems Network and intelligent transportation systems related technologies.

Planning and Administration

EXPECTED IMPLEMENTATION

The research outcome will help identify how the Arizona Department of Transportation, along with the Department of Public Safety and U.S. Department of Transportation, can enhance their collective motor carrier safety objectives. These successful accomplishments will lead to safer vehicles, safer drivers and an overall safer highway transportation environment, with an attendant drop in highway crashes and a decrease in resultant injuries and fatalities. The Motor Vehicle Division of the Arizona Department of Transportation will be the process owner.

STATUS OF THE RESEARCH

Phase 1 has been completed. Phase 2 is underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor & Champion: George N. Bays, MVD

Statewide Project Mgt.: David Mellgren

GSA, Desert Service Center: Robert Blanchard

US Customs & Border Protection: Armando Goncalvez

Dept of Public Safety: Lt. Terry DeBoer

MVD: Ric Athey

FHWA: Jennifer Brown and Ed Stillings

ATRC: John Semmens

Planning and Administration

SPR-544, What is the Best Mix of Service Delivery Strategies that Can Be Employed to Reduce Customer Time in Motor Vehicle Division Field Offices?

Research Agency:	Arizona Transportation Research Center	FY Authorization:	2005
Principal Investigator(s):	Ian Tingen & David Lovis-McMahon	Contract Date:	01/30/07
Contract Amount:	\$12,000	Sched. Completion Date:	12/31/07
Program Budget:	\$12,000	Estimated Completion Date:	12/31/07
Expenditures to date:	\$600	On schedule?	yes
Available Amount:	\$11,400	ADVANTAGE No.	R054417P
Percent complete through 6/30/07	5%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Registering a vehicle and obtaining a driver's license are among the major points of contact between the public and the Arizona Department of Transportation (ADOT). We want to be "customer friendly" and make these types of transactions as simple as possible. At the same time, ADOT must ensure that drivers are qualified and fees are paid.

To minimize cost and maximize customer satisfaction, transactions between customers and ADOT should be conducted as efficiently as possible. Some of these transactions can be conducted over the phone, by mail, or on the Internet. Other transactions (new driver's licenses, for example) require that the customer come to a Motor Vehicle Division (MVD) field office to take a vision or on-the-road test. There are an array of options and strategies for conducting these various transactions.

The question is, which set of options or strategies would be optimal for meeting the needs of ADOT and its customers?

RESEARCH OBJECTIVES

1. Compile a comprehensive list of transaction methods that might be used by the Motor Vehicle Division.
2. Describe the advantages and disadvantages of each method.
3. Where feasible, estimate a cost/benefit profile for each method.

EXPECTED IMPLEMENTATION

The research will result in information that could be used to guide a more effective Motor Vehicle Division customer service program in Arizona. MVD will be the process owner.

STATUS OF THE RESEARCH

The project is underway.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor & Champion: Holly Bowers, MVD

Motor Vehicle Division: David Acedo, Craig Reed

ITG: Jamie Rybarczyk

FHWA: Karen King

ATRC: John Semmens

Planning and Administration

SPR-547, Arizona Statewide Safety Project Analysis Model

Research Agency:	TRA	FY Authorization:	2005
Principal Investigator(s):	Jason Carey	Contract Date:	08/30/02
Contract Amount:	\$10,500	Sched. Completion Date:	12/31/06
Program Budget:	\$12,000	Estimated Completion Date:	12/31/07
Expenditures to date:	\$709	On schedule?	No
Available Amount:	\$11,291	ADVANTAGE No.	R054717P
Percent complete through 6/30/07	20%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

In June 2001, the Arizona Transportation Research Center (ATRC) completed a research project in which a model was developed for evaluating prospective safety projects on local government streets and roadways. This model enables the user to identify high crash locations based on total crashes, fatalities, and aggregate cost of crashes. Further, the model then permits the user to compare benefit/cost ratios for prospective safety improvements. The result is a tool that assists local governments in selecting the most cost-effective means for remedying the worst crash locations.

This proposed project would adapt the previously developed model to include State Highways in the database. This would enable a more comprehensive safety analysis of all roadways in Arizona. Users of the model would be able to identify and propose remedies for the worst crash sites regardless of the jurisdiction controlling the sites. Safety project investments could be optimized across jurisdictional boundaries and drivers in Arizona would enjoy the maximum pay-off in terms of reduced crash costs per dollar of investment no matter where they travel in the state.

RESEARCH OBJECTIVES

1. The existing database model will be enhanced to accommodate a statewide, multi-jurisdictional perspective.

EXPECTED IMPLEMENTATION

The research will result in a report and model that can be used by state and local governments to more effectively evaluate potential safety projects. The process owner would be the Transportation Planning Division, ADOT.

STATUS OF THE RESEARCH

The researcher promises that project will soon be completed.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor & Champion: Dale Buskirk, TPD

Governor's Traffic Safety Advisory Council: Richard Fimbres

Maricopa Association of Governments: Sarath Joshua

ADOT Risk Management: George Wendt

FHWA: Jennifer Brown

ATRC: John Semmens

Planning and Administration

SPR-571, Options for Reducing ADOT's Legal Liability Costs

Research Agency:	Bickmore Risk Services	FY Authorization:	2004
Principal Investigator(s):	Sandra Spiess & Mark Priven	Contract Date:	06/01/2007
Contract Amount:	\$40,000	Original Completion Date:	03/31/2008
Program Budget:	\$40,000	Estimated Completion Date:	03/31/2008
Expenditures to date:	0	Is project on schedule?	yes
Available Amount:	\$40,000	ADVANTAGE No.	R057116P
Percent complete through 6/30/07	0%	Responsible ATRC Staff:	John Semmens (Project Manager)

PROBLEM STATEMENT

The costs of litigation related to a variety of transportation operations is often an unanticipated cost. One major factor in the determination of legal cost is clearly an aspect of safety and how safe the facilities are technically as well as legally. Safety concerns are paramount in the design construction and operation of highway systems and related legal suits

The condition: It is not only the technical safety that brings about costs to the transportation system, but the perceived safety conditions that are subjected to legal suits that need definition. Assessing the magnitude and identifying means by which these amounts could be reduced may not only create major savings, but also lead to adjustments in the administrative operations that will reduce litigation and liability costs.

RESEARCH OBJECTIVES

1. First it is proposed to determine the annual average cost of legal liability currently compared to other DOTs nationally. Research the practices and policies that provide results that bring about less liability costs. It is proposed to define the reasons for and category of the liability losses.
2. Analyze legal options and define methods and means for the most cost efficient methods of reducing liability and settling lawsuits.
3. Obtain recommendations for policy changes, law requirement or resource needs.

ANTICIPATED BENEFITS

The results of such an inventory and definition of the magnitude might identify a variety of options: that more resources (lawyers) are needed to provide legal defense; that the basis for settlement of claims may need different parameters or measure, that added preparation technically could avert major legal costs or that the ADOT stands in the lead of national statistics for saving transportation funds in settlement of claims and litigation cases.

The annual cost of settlements of legal claims is about 12 million dollars annually. Even a 10% reduction in losses would save over \$1,000,000.

Planning and Administration

EXPECTED IMPLEMENTATION

AzDOT Risk Management will use the research findings to help reduce tort losses. This may involve a request for revisions to Arizona tort law.

STATUS OF RESEARCH

The project is underway

TECHNICAL ADVISORY COMMITTEE (TAC)

Jim Redpath	ADOT Attorney General's Office
George Wendt	ADOT Risk Management
Cindy Eiserman	ADOT Risk Management
Bruce Christianson	Arizona Department of Administration
Doug Forstie	Deputy State Engineer
Karen King	FHWA
Sonya Herrera	ADOT Safety
Jason Harris	ATRC
John Semmens	ATRC

Planning and Administration

SPR-583, Open Source Software Study

Research Agency:	ATRC	FY Authorization:	2004
Principal Investigator(s):	Sean Coleman	Contract Date:	03/27/07
Contract Amount:	\$13,650	Sched. Completion Date:	05/31/08
Program Budget:	\$15,000	Estimated Completion Date:	05/31/08
Expenditures to date:	\$1,228	On schedule?	Yes
Available Amount:	\$13,772	ADVANTAGE No.	R058016P
Percent complete through 6/30/07	15%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

ADOT currently spends over 1 Million dollars annually for software licenses, software maintenance, and support contracts for software in the enterprise. This covers both software on the desktop and server software. Open source software (OSS) such as the Linux operating system, Apache web server, Sendmail mail server, Open Office office suite, etc are all examples of stable, secure, reliable, and free software packages which could possibly replace existing commercial off-the-shelf (COTS) software.

RESEARCH OBJECTIVES

1. Determine where open source software may fit into the ADOT enterprise to replace current COTS software or add new functionality not covered by existing software.
2. Examine the benefits and risks of using OSS vs. COTS software within ADOT.
3. Estimate cost savings (Direct and Indirect) of utilizing OSS software within ADOT.

EXPECTED IMPLEMENTATION

ATRC will conduct the research with the assistance of one or more university graduate students. ADOT management will decide whether to adopt a new software standard.

This research will give ADOT an understanding of the expected costs, benefits, and risks involved with implementing OSS in the enterprise. ADOT will gain experience in OSS through piloting one or more applications to better understand some of the intangibles involved. ITG will be the process owner.

STATUS OF THE RESEARCH

The previous researcher resigned. A new researcher was hired.

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor: Joe Throckmorton, ITG
Champion: Jamie Rybarczyk, ITG
FHWA: Karen King
ATRC: John Semmens

Planning and Administration

SPR-598, Analysis of Bicycle Lanes (BL) Versus Wide Curb Lanes (WCL)

Research Agency:	Arizona Transportation Research Center	FY Authorization:	2005
Principal Investigator(s):	Andy Dennison	Contract Date:	03/01/07
Contract Amount:	\$15,000	Sched. Completion Date:	12/31/07
Program Budget:	\$15,000	Estimated Completion Date:	12/31/07
Expenditures to date:	\$2,700	On schedule?	yes
Available Amount:	\$12,300	ADVANTAGE No.	R059817P
Percent complete through 6/30/07	20%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

ADOT Bicycle Policy (MGT 02-01) became effective 3/1/02 and is scheduled for review (refer to <http://adotnet/divisions/itd/pnp/PDF/MGT/mgt021.pdf>). Excerpts from that policy state that it is ADOT's policy:

- Provide shared roadway cross-section templates;
- Consider, as a part of major new construction and major reconstruction in urban areas, Wide Curb Lanes up to 15' in width; and
- Consider bicycle lanes for inclusion with major new construction or major reconstruction when: 1) fully funded for construction and maintenance by a local agency AND 2) the bicycle lane is included as a part of a planned designated bicycle route approved by ADOT.

What is the appropriate type of bicycle facility on the State Highway System for cyclists? Some research, for example, concludes that: 1) BL cause problems to the extent that they encourage bicyclists and motorists to violate the rules of the road for drivers of vehicles, or 2) the best way to make most busy roads "Motorist Friendly in the Presence of Bicyclists, Resulting in Bicycling Friendliness" is to provide WCL, that they are simple, and simply better. The counterargument is that cycling is much safer and more popular precisely in those countries where bikeways, bike lanes, special intersection modifications, and priority traffic signals are the key to their bicycling policies. Finally, some studies conclude that both BL and WCL facilities can and should be used to improve cycling conditions.

RESEARCH OBJECTIVES

1. To provide a report that can be used by ADOT engineers to select the appropriate design to accommodate bicycle travel AND to help ADOT answer legitimate concerns while rebuffing unwarranted outside pressure to deviate from sound engineering practice.

EXPECTED IMPLEMENTATION

ATRC will conduct the research with the assistance of one or more university graduate students. ADOT management will determine whether to implement any changes in bicycle accommodation.

Planning and Administration

The research will result in data indicating which designs for accommodating bicyclists are most appropriate. The Transportation Planning Division of ADOT would be the process owner.

STATUS OF THE RESEARCH

The original researcher has resigned. Another has been hired.

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor: Dale Buskirk, TPD

Champion: Mike Sanders, TPD

Roadway Engineering: Mary Viparina

Traffic: Richard Moeur

ITD: Kenneth Cooper

FHWA: Karen King

ATRC: John Semmens

Planning and Administration

SPR-609, Driver Education for Safety in Adverse Driving Conditions

Research Agency:	Jack Faucett Associates	FY Authorization:	2006
Principal Investigator(s):	Jon Skolnik	Contract Date:	4/25/06
Contract Amount:	\$47,552	Sched. Completion Date:	12/31/07
Program Budget:	\$50,000	Estimated Completion Date:	12/31/07
Expenditures to date:	\$21,399	On schedule?	Yes
Available Amount:	\$28,601	ADVANTAGE No.	R060918P
Percent complete through 6/30/07	50%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Under certain adverse and unavoidable driving conditions, often times the driver of a vehicle gets confused, and ends up taking wrongful action leading to severe crashes. For example, a tire blow out in the middle of a high speed facility, driving during a dust storm, driving behind a large truck, running off the road, sudden bottleneck or emergency vehicles on the way, etc. Not knowing what to do to avoid an impending collision with another vehicle, median, trees, utility poles, or simply rolling over, many drivers do not take the right emergency action. Any wrongful action by a single driver on a roadway facility can result in crashes of various severities involving one or more vehicles and other road users.

The objective of this research is to ascertain how to educate drivers for safety under certain adverse and unavoidable driving conditions. An improved education program is expected to reduce the number of crashes, injuries as well as reduce the severity of crashes.

RESEARCH OBJECTIVES

1. Determine the state-of-the-art practices in educating drivers for safety in certain adverse driving conditions will be reviewed and summarized.
2. Determine whether any relevant laws and regulations related to driving in the State of Arizona need to be changed.
3. Develop a realistic module of a driver education program—including the estimated cost of implementation.

EXPECTED IMPLEMENTATION

ATRC will conduct the research with the assistance of a professional consulting firm. ADOT management will determine whether to advocate any changes in existing procedures or laws. If legislation is desired, ADOT will work with the governor and legislature to draft appropriate new laws.

The results of the research will be implemented by initially developing an optional driver education program, which can eventually be converted to a mandatory program. State agencies, like DPS, GOHS, ADOT, and other local agencies interested in promoting safety, in conjunction with any interested private agencies will be responsible for the implementation. Cost of

Planning and Administration

implementation will vary depending on the extent of education, and a preliminary cost will be determined through this research.

STATUS OF THE RESEARCH

The project is underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor: Reed Henry, Traffic & Safety

Champion: Kohinoor Kar, Traffic & Safety

GOHS: Richard Fimbres

MVD: Cydney DeModica

Risk Management: Cindy Eiserman

FHWA: Jennifer Brown

City of Phoenix: Kerry Wilcoxon

City of Tucson: Richard Nassi

ATRC: John Semmens

Planning and Administration

SPR-610, *Implementing a Statewide Rideshare Program in Arizona*

Research Agency:	Center for Transportation & the Environment	FY Authorization:	2006
Principal Investigator(s):	Wendy Morgan	Contract Date:	4/25/06
Contract Amount:	\$49,975	Sched. Completion Date:	12/31/07
Program Budget:	\$50,000	Estimated Completion Date:	12/31/07
Expenditures to date:	\$8,996	On schedule?	Yes
Available Amount:	\$41,004	ADVANTAGE No.	R061018P
Percent complete through 6/30/07	20%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Research the mobility benefits, operational logistics, and the legal aspects, and the funding options of establishing a state-level rideshare program to serve inter-regional mobility needs of employers and commuters.

RESEARCH OBJECTIVES

1. Develop an implementation plan that identifies priority corridors, mobilization issues, staffing, capital requirements, and operational issues.
2. Identify federal, state, and/or private funding options to implement the program.

EXPECTED IMPLEMENTATION

ATRC will conduct the research in two phases: (1) the literature review and identification of other state programs will be done with the assistance of one or more university graduate students, (2) the survey of employers and commuters will be done by a professional survey research firm. ADOT management will determine whether to implement any new programs. If legislation is required, ADOT will work with the governor and legislature to draft appropriate new laws.

The research will result in information that could be used to provide an affordable alternative for commuters who travel significant distances from their residence to employment centers within a region. PTD will be the process owner.

STATUS OF THE RESEARCH

The project is underway.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Champion: Jim Dickey, PTD

PTD: Matt Carpenter

FHWA: Ed Stillings

ATRC: John Semmens

Valley Metro: Gary Roberts

Pima County: Gayle Johnson

Planning and Administration

SPR-613, Quantifying the Impact of Opening a New Segment of Freeway

Research Agency:	Arizona Transportation Research Center	FY Authorization:	2005
Principal Investigator(s):	Jeff McLellan	Contract Date:	04/25/2006
Contract Amount:	\$12,000	Sched. Completion Date:	12/31/07
Program Budget:	\$15,000	Estimated Completion Date:	12/31/07
Expenditures to date:	\$3,780	On schedule?	Yes
Available Amount:	\$11,220	ADVANTAGE No.	R061317P
Percent complete through 6/30/07	30%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

We build and expand the capacity of urban freeways with the idea that they will help relieve urban street congestion. Critics contend that new freeways worsen congestion. What is needed is an examination of the impacts that new urban freeway segments have had on urban traffic. Using the Phoenix metropolitan region as a test case, data on traffic on adjacent and parallel city streets before and after the opening of new freeway segments or capacity additions could be used to quantify the changes resulting from the new facilities.

RESEARCH OBJECTIVES

1. Estimate and document the traffic impacts of new freeway segments in the Phoenix metropolitan region.
2. Determine whether the new freeways help relieve congestion.

EXPECTED IMPLEMENTATION

ADOT will use the information to improve the agency's reputation with the general public and elected officials.

The research will lay the groundwork for conveying the message of the cost-effectiveness of urban freeways for meeting urban travel needs. ADOT's Office of Strategic Management and Budget will be the process owner.

STATUS OF THE RESEARCH

The project is underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor & Champion: ADOT Deputy Director: Richard Travis
Communications & Community Partnerships: Matthew Burdick
MAG: Vladimir Livshits
FHWA: Karen King, William Vachon
ATRC: John Semmens

Planning and Administration

SPR-614, Origins and Destination Study for Older Persons

Research Agency:	Arizona Transportation Research Center	FY Authorization:	2005
Principal Investigator(s):	Kathleen Andereck	Contract Date:	04/25/06
Contract Amount:	\$15,000	Sched. Completion Date:	12/31/07
Program Budget:	\$15,000	Estimated Completion Date:	12/31/07
Expenditures to date:	\$3,645	On schedule?	Yes
Available Amount:	\$11,355	ADVANTAGE No.	R061417P
Percent complete through 6/30/07	25%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

As the baby boom ages those states like Arizona, and counties like Pima, that are a retirement destination will face challenges in relation to developing mobility options for aging populations. Many studies have been conducted about this problem, but have stopped short of following through with specific travel demand projections. We know that older and disabled persons have mobility issues, but we don't know specifically where they need to go. Most travel demand models are focused on the travel to work, but in Pima County less than half of the population make these types of trips. In order to get a better handle on what types of transportation solutions will work best for older travelers an origin and destination study needs to be conducted. Locations of 65 or older population densities in Tucson have already been identified.

RESEARCH OBJECTIVES

1. Conduct an origin and destination study for older travelers in the Pima County region via travel diary, surveys and other identified techniques
2. Determine a factor or adjustment that could be used in modeling to account for elderly traffic patterns
3. Suggest, based on the research and study, solutions to elderly mobility travel needs.

EXPECTED IMPLEMENTATION

ADOT Public Transit Division, ADOT Transportation Planning Division, Maricopa Association of Governments, Pima Association of Governments, United Way, Pima Council on the Aging, transit agencies.

The research will result in data on older person travel patterns that can be used to plan multimodal solutions to meet these needs.

STATUS OF THE RESEARCH

The project is underway.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor: Dale Buskirk

Champion: Pima Association of Governments: Lynn Potler

PTD: Mark Hoffman

Pima Council on the Aging: Jim Murphy

GRIC: Joyce Finckestein

United Way – Director of Supporting Seniors: Sharon Gartner

MAG: Maureen Decindis

SunTran – Amy Ramsey

Green Valley Community Coordinating Council: Ms. Joyce Finckestein

FHWA: Karen King

ATRC: John Semmens

Planning and Administration

SPR-618, *Land Use and Traffic Congestion*

Research Agency:	Richard Kuzmyak	FY Authorization:	2006
Principal Investigator(s):	Richard Kuzmyak	Contract Date:	01/30/2007
Contract Amount:	\$100,000	Sched. Completion Date:	12/31/07
Program Budget:	\$100,000	Estimated Completion Date:	12/31/07
Expenditures to date:	\$9,900	On schedule?	Yes
Available Amount:	\$90,100	ADVANTAGE No.	R061818P
Percent complete through 6/30/07	10%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

The way land is used affects the volume of traffic on the abutting streets. It is unclear whether sufficient attention is given to the traffic impacts of land use decisions. There is considerable controversy over whether the increased density would reduce or increase traffic congestion.

Better data on the relationship between land uses and traffic congestion could help us make better land use decisions. These better decisions could lead to reduced traffic congestion, improved air quality, and lower roadway infrastructure costs.

RESEARCH OBJECTIVES

1. Examine land use patterns and their contribution to mitigating or worsening traffic congestion.
2. Recommend options for policies that may be more conducive to reducing traffic congestion.

EXPECTED IMPLEMENTATION

The research will result in data indicating how different types of land use patterns contribute to traffic congestion and whether better decisions could lead to lessened traffic congestion. The Transportation Planning Division of ADOT would be the process owner.

STATUS OF THE RESEARCH

The project is underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Champion & Sponsor: Dale Buskirk

TPD: Charlene Fitzgerald

PAG: Kristen Zimmerman

Surprise: Randy Overmyer

FHWA: Karen King

ATRC: John Semmens

Planning and Administration

SPR-623, Increasing Vehicle Registration Compliance and Revenue through Proactive Identification

Research Agency:	ATRC	FY Authorization:	2006
Principal Investigator(s):	Kate Erzen	Contract Date:	01/29/2007
Contract Amount:	\$15,000	Sched. Completion Date:	06/30/2008
Program Budget:	\$15,000	Est. Completion Date:	06/30/2008
Expenditures to date:	0	On schedule?	yes
Available Amount:	\$15,000	ADVANTAGE No.	R062318P
Percent complete through 6/30/07	5%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Arizona Revised Statutes 28-2153 requires that vehicles be appropriately registered. There is no grace period for new residents who have current but out-of-state vehicle registrations. ADOT estimates that several million dollars *per year* are lost because of unregistered vehicles belonging to new residents. This loss is likely to increase as Arizona's population continues to grow through migration.

Currently, registration compliance is achieved through self-identification and enforcement efforts. Given the magnitude of lost revenue per year, neither of these alternatives is adequately effective. Another alternative, one that proactively identifies individuals who are likely to need Arizona vehicle registration, is needed.

An efficient and effective method to identify these individuals is to reference new residential utility activations. In rental units the water service is often paid for by the landlord; and not every residence, especially those built in the 1970s, has gas service. But practically every residence has electric service. Although electric service records will not capture every new resident (e.g., some rentals include the cost of all utilities), it is the best alternative available. Thus, new residential electric service activations provide an effective basis for identifying and informing residents of the need and process to fulfill Arizona vehicle registration requirements.

RESEARCH OBJECTIVES

1. Develop a data sharing prototype process with electric utility companies in a major metropolitan area to proactively identify new residents.
2. Determine the cost effectiveness of implementing the data sharing process on a statewide basis.

EXPECTED IMPLEMENTATION

The research will result in a data sharing prototype that may allow ADOT to significantly increase vehicle registration compliance and revenue. ADOT MVD will be the process owner.

STATUS OF THE RESEARCH

The project is underway.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor: Stacey Stanton

Champion: George Lamb

FHWA: Karen King

ATRC: John Semmens

Planning and Administration

SPR-636, “Heat Island” Effect of Pavements

Research Agency:	Arizona State University	FY Authorization:	2007
Principal Investigator(s):	Jay Golden & Kamil Kaloush	Contract Date:	01/19/2007
Contract Amount:	\$50,000	Sched. Completion Date:	06/30/2008
Program Budget:	\$50,000	Est. Completion Date:	06/30/2008
Expenditures to date:	0	On schedule?	yes
Available Amount:	\$50,000	ADVANTAGE No.	R063619P
Percent complete through 6/30/07	5%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Current methods to pave roadways and parking lot surfaces have an unintended, and often undesired effect of raising the ambient temperature in the area. Dense urbanized area can see increases in sub-zones sufficient enough to raise health concerns for the elderly and very young as well as increase energy costs for cooling building interiors. New technologies could offer other solutions to paving surfaces that might mitigate to some degree this effect. Once these alternative techniques are identified areas that suffer from a heat island effect could require the use of these new technologies to reduce and mitigate this effect.

RESEARCH OBJECTIVES

1. Estimate the “heat island” effect of various paved surfaces.
2. Recommend options for mitigating this effect.

EXPECTED IMPLEMENTATION

The research will provide data that could be used to mitigate “heat island” impacts of its paving activities. The ADOT Process owner would be the Transportation Planning Division.

STATUS OF THE RESEARCH

The project is underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor: Dale Buskirk
ADOT Materials: Paul Burch
TPD: Beverly Chenausky
Environmental: Mark Hollowell
Champion: PAG: Cherie Campbell
FHWA: Tom Deitering
ATRC: John Semmens

Planning and Administration

SPR-637, Cost/Benefit Analysis of Electronic License Plates

Research Agency:	ATRC	FY Authorization:	2006
Principal Investigator(s):	Andrew Eberline	Contract Date:	12/06/2006
Contract Amount:	\$15,000	Sched. Completion Date:	10/31/08
Program Budget:	\$15,000	Est. Completion Date:	10/31/08
Expenditures to date:	\$750	On schedule?	yes
Available Amount:	\$14,250	ADVANTAGE No.	R063718P
Percent complete through 6/30/07	5%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Electronic Plates (E-Plates) combine visual identification (i.e. alpha numeric plate format), along with an electronic verification system (electronic sensors imbedded in plate or plate mounting material.) Each plate has a unique identifier, not unlike the validation tab system.

The technology allows for a variety of uses: management of traffic flow (Britain has used it to stagger speed limits based on traffic congestion); road safety - traffic incident management; travel history - insurance company ability to monitor miles traveled, speed limits, etc.; registration compliance (tracking movement of vehicles currently registered or not).

The E-Plate registers on sensors mounted on rigid road readers or in mobile units. Enforcement of traffic laws, the tracking of criminals, collection of revenues, and management of traffic congestion could all be improved if vehicles had electronic license plates. An electronic license plate would enable the use of more sophisticated technologies to track and manage these objectives.

The question is what would it cost to implement an electronic license plate and whether the expected benefits would exceed this cost.

RESEARCH OBJECTIVES

1. Conduct a thorough evaluation of the advantages and disadvantages of electronic license plates.
2. Estimate the required cost of implementing electronic license plates in Arizona and compare these costs to expected benefits.

EXPECTED IMPLEMENTATION

The research will result in information on the prospective value of an investment in electronic license plate technology for the state of Arizona. With this information, more effective investment of public funds in highway transportation will be possible. ADOT management will decide whether to pursue the legislation that may be necessary to fully implement an electronic license plate system. MVD will be the process owner.

STATUS OF THE RESEARCH

The project is underway.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor: Michael Veucasovic, MVD

Champion: Ric Athey, MVD

TOC: Scott E. Nodes

DPS: Dennis Young

FHWA: Karen King

ATRC: John Semmens

Planning and Administration

SPR-639, Effectiveness of Various Pre-Emergent Herbicides

Research Agency:	ATRC	FY Authorization:	2006
Principal Investigator(s):	Mike Lopker	Contract Date:	12/22/2006
Contract Amount:	\$10,000	Sched. Completion Date:	12/31/07
Program Budget:	\$15,000	Est. Completion Date:	12/31/07
Expenditures to date:	\$4,500	On schedule?	yes
Available Amount:	\$10,500	ADVANTAGE No.	R063918P
Percent complete through 6/30/07	50%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Currently, ADOT does not have specifications describing one or more product(s) that are proven to control weeds better than others. The selection of a type of pre-emergent herbicide is often left up to the contractor to decide, resulting in less quality products being used and undesirable weed growth.

ADOT needs to do a comparison study of the effectiveness of various pre-emergent herbicides predominantly used for the control of weeds within the urban freeway landscape system.

RESEARCH OBJECTIVES & TASKS

1. The researcher will review the existing literature on herbicides to assess product availability and asserted performance.
2. With the assistance of the ATRC, the researcher will conduct a brief survey other transportation agencies to ascertain other DOT's experience with various herbicides.
3. Based on tasks #1 and #2, the researcher will recommend a selection of herbicides to be tested and design a test protocol that will be followed by ADOT District Maintenance.
4. ADOT District Maintenance will purchase and apply the herbicides as outlined in the test protocol.
5. The researcher will do an "after" evaluation of the test sites and interview ADOT Maintenance personnel to get their opinions on the relative effectiveness of the tested herbicides.
6. The researcher will write a report documenting the results of tasks #1 through #5 and recommend cost-effective herbicide solutions for ADOT's weed control needs.

EXPECTED IMPLEMENTATION

ATRC will conduct the research in two phases. One phase will consist of pre-application analysis of options. The other will consist of remedy applications in a pilot test and evaluation of results. The ultimate objective will be to determine if there are more cost-effective means for controlling weeds on the ADOT rights-of-way.

STATUS OF THE RESEARCH

The project is underway.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Sponsor: Tim Wolfe, Phx. Maint. Dist Office

Champion: Kirk Kiser, ADOT Landscape Const.

District Maintenance: Mark Schalliol

Natural Resources: Bruce Eilerts,

FHWA: Karen King,

ATRC: John Semmens

Planning and Administration

SPR-640, Cost-Effectiveness of Mobile Enforcement

Research Agency:	Arizona Transportation Research Center	FY Authorization:	2006
Principal Investigator(s):	Uyen Tran	Contract Date:	03/06/2007
Contract Amount:	\$15,000	Sched. Completion Date:	05/31/08
Program Budget:	\$15,000	Estimated Completion Date:	05/31/08
Expenditures to date:	0	On schedule?	Yes
Available Amount:	\$15,000	ADVANTAGE No.	R062018P
Percent complete through 6/30/07	5%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Currently, MVD attempts to enforce weight limits and safety regulations for commercial vehicles through ports-of-entry and mobile details. It is the unanimous opinion of those charged with enforcement responsibility that this effort is under-funded. Yet, this opinion has been insufficient to persuade decision makers to increase the budget allocated to enforcement.

ADOT needs to do a study of the effectiveness of enforcement efforts. This particular study would focus on the mobile enforcement activities in order to determine if the benefits in terms of fines & fees collected, pavement damage avoided and crashes averted due to enforcement efforts exceed the costs of mobile enforcement details.

If we can quantify the benefits and costs per unit enforcement effort, we can establish an optimal level of effort. The purpose of this study would be to examine the costs of mobile enforcement details and compare them to the estimated impacts in terms of revenues gained, costs avoided and crashes averted directly resulting from the enforcement effort.

RESEARCH OBJECTIVES

1. The researcher will review the existing literature on mobile enforcement to assess the current state-of-the-practice.
2. With the assistance of the ATRC, the researcher will conduct a survey of other transportation agencies to ascertain whether they have ascertained benefit/cost relationships for their mobile enforcement efforts.
3. The researcher will examine data from a representative sample MVD mobile enforcement details in order to estimate costs vs. benefits.

EXPECTED IMPLEMENTATION

It is expected that the study results will help guide MVD and ADOT to implement a more cost-effective mobile enforcement program.

STATUS OF THE RESEARCH

The project is underway.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Project Champion: Steve Abney, MVD Enforcement

Project Sponsor: Stacey Stanton, MVD Director

MVD: Steve Abney, Ric Athey, Michael Veucasovic,

FHWA: Karen King

Structures: Jean Nehme

ATRC: John Semmens

Planning and Administration

SPR-641, Over-Dimensional Vehicle Routing Study

Research Agency:	Arizona Transportation Research Center	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	12/31/08
Program Budget:	\$15,000	Estimated Completion Date:	12/31/08
Expenditures to date:	0	On schedule?	Yes
Available Amount:	\$15,000	ADVANTAGE No.	R062019P
Percent complete through 6/30/07	5%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Oversized and overweight vehicles present unique demands on the road system. Vehicle, weight, width, length, and/or height make it impossible to travel on some roads and difficult to travel on others. This increases the time and expense of transporting these large, indivisible loads and, in some cases, may prohibit access to the desired client user or critical infrastructure point. In order to ascertain whether there are feasible and cost-effective ways of reducing the time and expense incurred in transporting such items we must first identify the magnitude of the current problem.

The Arizona Department of Transportation (ADOT) needs to do a study examining the frequencies and routes taken for moving these over-dimensional and/or overweight loads as a first step toward determining practical steps for dealing with these shipments. If we can get a reasonable estimate of the cost of the current methods for accommodating these shipments we will have a better idea of whether different methods of accommodating these shipments ought to be explored.

RESEARCH OBJECTIVES

The initial objectives are to gather information that will help ADOT decide whether:

1. The problem is too small to justify further study or action.
2. The problem is significant enough to warrant an initial corridor pilot study to evaluate over-dimensional vehicle obstacles on a segment of a specific corridor and delivery delays and associated costs created – compared with potential correction costs for the corridor.

EXPECTED IMPLEMENTATION

It is expected that the study results will inform a decision on whether to proceed to an additional phase of study.

STATUS OF THE RESEARCH

The project is underway.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Project Champion: Dale Buskirk, Transportation Planning Division

Project Sponsor: Jean Nehme, Bridge Group

Trucking Industry: Richard Dungan

Prescott District: John Fought

Phoenix Maintenance District: George Chin

Materials: Paul Burch

MVD: Steve Abney

FHWA: Ed Stillings

ATRC: John Semmens

Planning and Administration

SPR-642, Delivery of a Technical Curriculum Using Learner-Based Instruction and Communication Modalities in a Distributed Environment

Research Agency:	Arizona Transportation Research Center	FY Authorization:	2007
Principal Investigator(s):	Larry Ellis	Contract Date:	NA
Contract Amount:	NA	Sched. Completion Date:	05/31/08
Program Budget:	\$24,000	Estimated Completion Date:	05/31/08
Expenditures to date:	0	On schedule?	Yes
Available Amount:	\$24,000	ADVANTAGE No.	R064219P
Percent complete through 6/30/07	5%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

The complexity and volume of information a Motor Vehicle Division (MVD) Customer Services Representative must learn have increased geometrically because of new federal and state homeland security requirements, increasingly complex connectivity among the 49 states and foreign jurisdictions, and the movement of foreign state populations, organizations, products and services into and through Arizona. As in migration continues to exceed out migration, more MVD services will be required to serve the public throughout the state.

Pressure to keep wait times at a designated level, marginal funding to support the increased demand for services, and non-productive lost time traveling to and from a training site have impacted how training can be delivered without requiring additional resources and in the shortest amount of time possible.

Because of the increasing size of the population, the expanded scope of training, and the scarcity of resources, training must be made as effective as possible at a minimum cost in the shortest amount of time. Pure asynchronous delivery was tested several years ago and failed because of the changing profile of the students, the turnover of students and trainers, and the minimally effective results of technical instruction without direct instructor access. For the non-traditional form of training and learning to be effective, the students must have direct and timely access to an instructor and to multimedia learning modalities to ensure maximum understanding. This study will identify what technology should be used to blend a learning program for use in a distributed environment.

RESEARCH OBJECTIVE

1. The research should identify a blended training infrastructure that will integrate with ADOT's hardware, software, communications links, networks, and the existing Department Learning Content Management System (LCMS). The systems that will be evaluated should meet training and communication needs of all ADOT, not just MVD.

EXPECTED IMPLEMENTATION

The project will identify needs for desired training technology based infrastructure, develop and pilot-test an integrated virtual technology training and communications program.

Planning and Administration

STATUS OF THE RESEARCH

The project is underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Project Champion: John Carlson, MVD Assistant Director

Project Sponsor: Stacey Stanton, MVD Director

ITG: Omar Guillen, Cyndi Striegler,

MVD: Mary King; Larry Ellis, Karen Harmon,

ITD: Annie Parris, Diane Minton

FHWA: Karen King

ATRC: John Semmens

Planning and Administration

SPR-646, AASHTOWare Turborelocation Software Development

Research Agency:	AASHTO	FY Authorization:	2008
Principal Investigator(s):	Tony Bianchi	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	12/31/09
Program Budget:	\$100,000	Estimated Completion Date:	12/31/09
Expenditures to date:	0	On schedule?	Yes
Available Amount:	\$100,000	ADVANTAGE No.	R064620P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Payment of relocation benefits is mandated by federal regulation and state law. A relocation software package would provide agencies with the ability to allocate scarce personnel and resources to carry out relocation calculation and documentation functions that meet both federal and state requirements in a consistent manner. FHWA supports this project. AASHTO will manage the pooled fund phase of the project with participation from multiple states to pay for the product design. ADOT-R/W IT support will conduct the phase 2 implementation.

RESEARCH OBJECTIVE

This project would be conducted in two phases. The first phase (\$90,000) entails cooperation in a pooled fund effort to develop a web-based application that is easy to implement (i.e., has low in-house IT resource requirements) and has the ability to create reports both for state and federal reporting requirements. The second phase (\$10,000) will entail implementing the results of phase 1 by customizing the model to ADOT's precise needs.

EXPECTED IMPLEMENTATION

States that participate in the project will own a copy of the finished product. Pooled fund product would be owned by AASHTO. R/W will own ADOT's customized version.

STATUS OF THE RESEARCH

The project is not yet underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Project Champion: Sam Maroufkhani, Assistant State Engineer
Project Sponsor: Sabra Mousavi, Chief R/W Agent (ph. 6840)
Ben Black, ADOT-R/W IT support, Dianna Ayers, Washington DOT; Perry Johnston, Arkansas DOT; Rick Kauzlarich, Alaska DOT; Carmen Reese, Idaho DOT; Arnold Feldman, FHWA, Susan Lauffer, FHWA, Arnold Feldman, FHWA, John Semmens, ATRC, Tony Bianchi, AASHTO Project Manager (tbianchi@ashto.org, phone: (202)624-5821

Planning and Administration

SPR-654, Options & Impacts of Measures to Reduce Single-Occupant Vehicle (SOV) Traffic

Research Agency:	Pending	FY Authorization:	2008
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	12/31/08
Program Budget:	\$50,000	Estimated Completion Date:	12/31/08
Expenditures to date:	0	On schedule?	Yes
Available Amount:	\$50,000	ADVANTAGE No.	R065420P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

Arizona's population is growing and with all the opportunities this will bring to the State, one of the major concerns is transportation gridlock on local streets and state highways. Perhaps incentives like tax credits for reduced personal mileage, payment for not driving alone, increased effort on ability to work at home, grocery delivery to the home, personal services at the work site or disincentives like tolls, personal tax based on higher than average mileage in a year, charge for parking (work and social) could have a significant impact.

We need to consider more aggressive measures for reducing traffic congestion. The two largest cities Phoenix and Tucson already have Travel Reduction Ordinances in place targeted to employers to reduce employee drive alone trips to the work site. While these programs are making a contribution, something much stronger and dynamic may need to be implemented to increase the impact on traffic congestion.

RESEARCH OBJECTIVE

The objective would be to estimate the magnitude of impact and effectiveness of various plausible incentives and disincentives to reduce SOV travel. The research should identify the most promising options and recommend a pilot test protocol for ascertaining the effectiveness of one or more of these options in an Arizona location.

EXPECTED IMPLEMENTATION

It is expected that the study will result in a follow-up pilot test that will help guide future widespread measures to reduce SOV travel.

STATUS OF THE RESEARCH

The project is not yet underway.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Project Champion: Cherie Campbell (PAG)

Project Sponsor: Dale Buskirk (TPD)

PAG: Rita Hildebrand

PTD: Jim Dickey

Valley Metro RPTA: Betsy Turner,

State RideShare: Abby Williams or Kayelen Rolfe

FHWA: Karen King

ATRC: John Semmens

Planning and Administration

SPR-655, Identifying Customer-Focused Performance Measures

Research Agency:	Pending	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	12/31/08
Program Budget:	\$100,000	Estimated Completion Date:	12/31/08
Expenditures to date:	0	On schedule?	Yes
Available Amount:	\$100,000	ADVANTAGE No.	R065519P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	John Semmens

PROBLEM STATEMENT

The goal of this research is to develop performance indicators from the perspective of residents, without reference to which section of the Arizona Department of Transportation (ADOT) performs the work. No research or involvement of residents has occurred to determine if performance measures currently used by ADOT are aligned with the measurements desired by residents. The research would incorporate input from residents to develop agency performance measures by addressing questions such as, “Where should ADOT be focusing its efforts?” and “What’s important to residents?” This research would determine issues that residents regard as important performance indicators for the agency to be successful. The research would make recommendations for communicating performance measures to residents by creating a cycle of input given, indicators adopted, performance measured and results communicated.

RESEARCH OBJECTIVE

Evaluate procedures used elsewhere for measuring performance from the perspective of residents. Define a catalog of services to educate residents about ADOT responsibilities. Assess how Arizona residents perceive the indicators of our successful performance. Develop a user-friendly process to communicate with residents about the performance of ADOT.

EXPECTED IMPLEMENTATION

It is expected that the study will create performance measurements that can be repeatedly used in the fulfillment of the Department’s strategic plan and set up a system for regularly communicating progress to residents and government decision makers.

STATUS OF THE RESEARCH

The project is not yet underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Project Champion: Matt Burdick, CCP

Project Sponsor: John Bogert, Chief of Staff

FHWA: Karen King

ATRC: John Semmens

Structures

Structures – PROJECTS

SPR-493, Bridge Foundation Design Parameters and Procedures for Bearing in SGC Soil

Research Agency:	Arizona State University	FY Authorization:	2000
Principal Investigator(s):	Dr. Bill Houston	Contract Date:	11/18/00
Contract Amount:	\$214,808	Sched. Completion Date:	05/17/02
Program Budget:	\$214,808	Est. Completion Date:	11/30/04
Expenditures to date:	\$180,596	Is project on schedule?	No
Available Amount:	\$34,212	ADVANTAGE No.	R0493 12P
Percent complete Through 6/30/07	90%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

Drilled shaft foundations support a significant portion of the bridge substructures in Arizona. These drilled shafts are commonly supported in mixed soils types known as sand-gravel-cobbles (SGC) layer and derive their capacities from side friction and end bearing in SGC layer. Current design procedures and parameters are based on uniform soil conditions. Soils medium is modeled either as clay or sand. Limited amounts of research data are available for design of drilled shafts supported in granular soils with significant gravel and cobble contents. Current American Association of State Highway and Transportation Officials (AASHTO) design method for drilled shafts in granular soils medium is based on the equations proposed by Reese and O'Neil (Federal Highway Administration (FHWA) Procedure). Meyerhoff and Kulhawy developed the other two common design procedures. Available load test data indicate that measured drilled shaft capacities tend to be larger with an increase in gravel content of the granular soils than the design capacities. Additionally, the capacity tends to increase with the increase of calcium carbonate cementation. However, definitive relationships among these variables and corresponding design parameters are not available for general design applications. Drilled shafts in mixed soils (i.e., SGC) conditions will support significant number of bridge foundations in the future. Significant savings could be realized if design parameters and procedures could be developed to account for the increase in friction of soils with the increase of gravel content and calcium carbonate cementation.

RESEARCH OBJECTIVES

1. Prepare an evaluation of the current AASHTO design methods for Drilled Shaft foundation.
2. Prepare a comparative analysis of Drilled Shaft foundations based on AASHTO design method and those based on load tests in granular soils with gravel and cobbles.
3. Evaluate the added strength of soils due to the presence of gravel and cobbles along with/without cementation in soils.
4. Recommend changes in design parameters and design procedures.

The following tasks will be performed:

Structures

1. Develop a Technical Advisory Committee (TAC).
2. Meet with TAC to prepare a Scope of Work and select a consultant.
3. Conduct a literature search on the issues of drilled shaft foundation design in granular soils.
4. Conduct an evaluation of the current AASHTO design methods for drilled shaft foundation, for their basis and limitations in regard to SGC materials.
5. Prepare a comparative study of drilled shaft capacities based on AASHTO design methods and those based on load test data in granular soils with gravel and cobbles.
6. Identify the design parameters that could be modified to account for additional capacities of drilled shaft foundation in SGC soils with and without cementation.
7. Develop design parameters and procedures for drilled shafts supported by SGC soils.
8. Prepare a memo for submittal to AASHTO Technical Committee T-15 for revision of the AASHTO procedure for design of drilled shaft foundations.
9. Document the research efforts and findings in a final report.

EXPECTED IMPLEMENTATION

The research has resulted in an evaluation of the current AASHTO design method for drilled shaft foundations based on the available load test data on drilled shafts in SGC soils. The research has provided information to be used to improve the design of drilled shaft foundations for bridges and structures.

STATUS OF THE RESEARCH

The research has been basically completed during the past year. Research work was on hold while a separate effort to initiate a related Federal Pooled Fund project was monitored. The completed final draft report has been submitted to ATRC for review before publication.

TECHNICAL ADVISORY COMMITTEE (TAC)

Dan Heller	TY Lin, Inc.
Shafi Hasan	Bridge Engineering, ADOT
J.J. Liu	Materials, ADOT
Doug Alexander	Materials, ADOT
Aryan Lirange	FHWA
Christ Dimitroplos	ATRC, ADOT

Structures

SPR-538, High Performance Concrete for Bridge Structures in Arizona

Research Agency:	Jabar Engineering	FY Authorization:	2002
Principal Investigator(s):	Tarif Jabar, P.E.	Contract Date:	August 2003
Contract Amount:	\$275,000	Sched. Completion Date:	May 2005
Program Budget:	\$275,000	Est. Completion Date:	Sept 2006
Expenditures to date:	\$196,000	Is project on schedule?	Yes
Available Amount:	\$79,000	ADVANTAGE No.	R053814P
Percent complete through 6/30/07	75%	Responsible ATRC Staff:	Christ Dimitroplos (Project Manager)

PROBLEM STATEMENT

In order to stimulate the use of higher quality concrete in highway structures, the Federal Highway Administration has strongly promoted high performance concrete (HPC) materials. High performance concrete has been found to be feasible in all aspects of concrete bridges including the decks, piers, and pre-stressed concrete girder cross-sections. Several studies have indicated that using concrete compressive strengths of up to 10,000 psi allowed longer span lengths and more economical structures. Many state agencies have thus saved construction time and money by using high performance concrete. One of the reasons why HPC is not regularly specified for highway structures in Arizona may be the lack of available data regarding the field use in hot and arid climates. This proposal will seek to develop and implement the use of high performance concrete in Arizona's bridges.

RESEARCH OBJECTIVES

The objectives of this research project are to evaluate the applicability of using high performance concrete in structures in Arizona and to determine any climate-related issues associated with the use of high performance concrete.

Action Plan - Tasks

The researcher will accomplish the following tasks:

1. Meet with the Technical Advisory Committee to discuss the scope of work and action plan.
2. Conduct a literature and research-in-progress search and review the practice within Arizona, other departments of transportation, and throughout the industry. Prepare a state-of-the-art/state-of the practice report.
3. In addition to improved durability effects, the effect of using HPC in the deck will be evaluated on the flexural strength, ductility, pre-stress losses, and long-term deflections of the superstructure
4. Several mix designs will be developed and used in a laboratory-testing program. Performance based tests will be conducted to assess the characteristics of the materials.
5. Prepare a plan and specifications for the design and construction of a designated high performance concrete bridge project in Arizona. The plan shall include high performance concrete mixtures for the Arizona Department of Transportation Bridge Group to use for the

Structures

design of bridge columns, girders, and decks. The plan will also address the curing requirements, shrinkage cracking, strength, and toughness requirement.

6. Results will be documented and compiled as a user-manual for high performance concrete in bridge structures in hot and arid climates. A cost analysis study will be performed. Results will be used to identify possible modifications to current practice.
7. Document the research effort and findings in a final report in accordance with ATRC guidelines.

EXPECTED IMPLEMENTATION

This project will increase the acceptability of high performance concrete materials in the local community. It will help address some of the process, parameters, and design challenges faced by the bridge group in designing cost-effective, compact, and strong structures through the use of higher strength materials. By reducing extra piers and members, it may reduce the size requirements of many new and rehabilitated structures. The research results were tested on Sunshine Bridge in Holbrook. A draft report is being completed.

STATUS OF THE RESEARCH

Consultant contract awarded and research project underway. Literature research completed.

TECHNICAL ADVISORY COMMITTEE (TAC)

Aryan Lirange	Federal Highway Administration
Jean Nehme	Bridge Group
Oscar Mousavi	Materials
Henry M. Sung	Bridge Design
Greg Lingor	Parsons Group
Shawn Farahzadi	Construction
	Construction Inspection
	District Engineer

Structures

SPR-586, Earth Pressures on Cantilevered Retaining Wall

Research Agency:	Pending	FY Authorization:	2005
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Sched. Completion Date:	October 2005
Program Budget:	\$150,000	Est. Completion Date:	October 20005
Expenditures to date:	\$0	Is project on schedule?	No
Available Funds	\$150,000	ADVANTAGE No.	R0586 17P
Percent complete through 6/30/07	0%	Responsible ATRC Staff:	Christ Dimitroplos (Project Manager)

PROBLEM STATEMENT

A number of significant research projects related to backfill material for retaining structures have been performed over the last decade. Cohesive soil, controlled low strength materials (CLSMs), recycled tire chip soil mix and more were studied for backfill material. Neither recycled asphaltic pavement (RAP) nor recycled crushed concrete backfill mix have been included in these studies. Recently contractors on several ADOT construction projects proposed using recycled concrete materials for structure backfill behind concrete cantilever retaining walls. Contractors have claimed that recycling existing concrete material from pavement removal in the vicinity of the project and using the material for the structure backfill behind the new retaining wall construction would be a significant cost saving idea.

ADOT Geotechnical Design Section of Materials Group and Bridge Design Sections of Bridge Group are very Group are hesitant to adopt the application of the proposed backfill material because of unavailability of data for design parameters for these materials unless extensive research is performed in this area. These design parameters consist of unit weight, internal frictional angle, shear strength, permeability, compaction, moisture content etc. The amount of moisture retained in the backfill material is directly related to the permeability of backfill and will greatly affect the earth pressure acting on the wall. The gradation of the mix will also affect performance properties of the backfill material. The findings of this investigation will provide ADOT the necessary information for evaluating the proposed materials objectively. Future use of these materials is heavily dependent on the results of this research.

RESEARCH OBJECTIVES

Investigate the performance of concrete cantilever retaining walls having (1) Structure Backfill meeting ADOT's current specifications (2) Structural Backfill consisting of a mixture of recycled asphaltic concrete and virgin aggregate material (3) Structural Backfill consisting of a mixture of recycled Portland Cement Concrete and virgin aggregate material.

1. Identify appropriate blend percentages for mixtures containing recycled and virgin aggregate materials.
2. Identify quality and gradation requirements for the above backfill materials
3. Establish backfill drainage and compaction criteria.
4. Investigate earth pressure and pore water pressure on wall face.
5. Examine the effect on backfill settlement, including long-term effects if any.

Structures

RESEARCH TASKS

1. Develop a Technical Advisory Committee (TAC).
2. Meet with TAC to prepare a scope of work and select a consultant.
3. Conduct a brief literature search on the topic of structural backfill for retaining walls, including the use of recycled materials.
4. Select and establish sample mixes for each of the types of backfill materials mentioned in Research Objectives.
5. Conduct necessary soil tests in order to obtain design parameters for the selected backfill sample mixes so that unit weight, internal frictional angle, shears strength, etc. can be determined. Evaluate the affect of time and temperature on the engineering properties and performance of Structural Backfill materials containing RAP.
6. Provide performance curves for the relevant design parameters as a function of blend percentage to justify an allowable maximum amount of recycled material in structural backfill.
7. Document the research effort and findings in a final report. The report should enable ADOT to evaluate the benefit of using recycled concrete materials versus conventional backfill materials.
8. Develop specifications, placement procedures/conditions, and evaluate testing requirements/feasibility for controlling the use of these materials.
9. If the finding indicates that using recycled concrete backfill materials for concrete cantilever retaining wall has the advantage in cost and quality over the conventional structural backfill material, ADOT Bridge Group will evaluate whether redesigning of the ADOT standard retaining wall is warranted.

EXPECTED IMPLEMENTAION

This research will provide the technical information to ADOT with which to accurately evaluate the quality and value of using a variety of concrete backfill mixes that are proposed by contractors.

STATUS OF RESEARCH

This research has not yet begun.

TECHNICAL ADVISORY COMMITTEE

(Proposed) Scott Weinland, Regional Materials; Henry Sung, Bridge Group; John Ivanov, Materials Group; Christ Dimitroplos, ATRC; James Wilson, Materials Group

Traffic and Safety

Traffic and Safety – PROJECTS

SPR-591, High Crash Risk Unsignalized Intersections

Research Agency:	University of Arizona	FY Authorization:	2005
Principal Investigator(s):	Dr. Wei Hua Lin	Contract Date:	October 2004
Contract Amount:	\$62,500	Original Completion Date:	November 2005
Program Budget:	\$62,500	Estimated Completion Date:	September 2007
Expenditures to date:	\$26,670	Is project on schedule?	Yes
Available Amount:	\$23,330	ADVANTAGE No.	R059117P
Percent complete through 6/30/07	70%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

Unsignalized intersections represent potential hazards not present at signalized intersections because of the priority of movement on the main road and significant speed difference as well as drivers' and pedestrians' perceptions. As a result, information such as traffic volume, highway geometric features and traffic control data is crucial to the crash analysis in addition to crash information. The current Arizona Department of Transportation (ADOT) program for identifying hazardous unsignalized intersections is challenged by the crash data limitation. For example, in some cases, one cannot tell from some crash records whether a crash occurred at a signalized-intersection or at an unsignalized intersection. The traditional analysis is further deteriorated by Regression-to-the-Mean (RTM) due to the random fluctuation of crash occurrence from year to year at a location. In other words, a short time period observation of a location may not provide a solid indication of the safety status of that location. The entire process is aggravated by the lack of staffing in terms of time and knowledge. Therefore, a systematic process is required to tackle all the aforementioned problems.

By streamlining the process, crash data can be combined with other data sources available at MAG and other jurisdictions to improve data coverage and data quality. The EB method can be adopted to overcome the RTM. Moreover, the GIS technologies can be incorporated into the process to save staff's time in data processing. For instance, routes and crashes can be overlaid with aerial photograph to provide the engineer with a better picture of the roadway configuration of a crash site. Various tools such as spot identification and corridor analysis will enhance the engineer's ability to analyze unsignalized intersection safety problems at a project, corridor or even a network level.

RESEARCH OBJECTIVES

Develop a GIS based screening process to systematically identify high crash risk at unsignalized intersections using Empirical Bayesian (EB) approach. The process is also instrumental in analyzing and addressing the crash causes which can potentially be utilized to support the future effort in implementing the AASHTO Highway Safety Plan.

Traffic and Safety

The proposed project will make various types of supplemental information for crashes easily accessible to traffic engineers. More importantly, it could potentially avoid subjective judgment or bias in observation as a result of RTM and ensure the efficient and effective allocation of ADOT Hazard Eliminate Safety (HES) funds.

This research project will also identify the problem of the current system, compare the current system with alternative systems, and recommend further improvements and reducing construction costs. Our current databases do not contain the necessary data (i.e., approach geometrics, traffic control, volume) to do a systematic approach to improving safety at unsignalized intersections.

EXPECTED IMPLEMENTATION

The ability to identify truly hazardous intersections is crucial for the safety of the Arizona transportation system and the agencies responsible for spending safety dollars. It is important that these locations can be identified through a systematic approach. A systematic process will enable the engineers to effectively propose safety projects that will have the greatest safety impact system wide and provide management with the necessary information that the worst locations are being addressed. It is anticipated that the results of this research can be assimilated in the development of other hazardous locations such as signalized intersections, roadway segments etc.

STATUS OF RESEARCH

The research is on-going with an anticipated completion date of June 2007.

TECHNICAL ADVISORY COMMITTEE (TAC)

Reed Henry	ADOT Safety
Nancy Ann Crandall	ADOT Safety
Jami Garrison	ADOT
Jennifer Brown	FHWA
Robert Maki	Surprise City Engineer
Larry Talley	Mesa Traffic Studies Analyst
Kerry Wilcoxon	Phoenix Traffic Safety
Sarath Joshua	MAG

Traffic and Safety

SPR-592, Building Tribal Traffic Safety Capacity

Research Agency:	Inter Tribal Council	FY Authorization:	2005
Principal Investigator(s):	Esther Corbett	Contract Date:	October 2004
Contract Amount:	\$110,000	Original Completion Date:	November 2005
Program Budget:	\$110,000	Estimated Completion Date:	December 2007
Expenditures to date:	\$45,000	Is project on schedule?	Yes
Available Amount:	\$65,000	ADVANTAGE No.	R059217P
Percent complete through 6/30/07	80%	Responsible ATRC Staff:	Jason Harris (Project Manager)

PROBLEM STATEMENT

Motor vehicle crashes (MVC) are a major cause of injuries and fatalities for American Indians traveling on state highways and other roads on reservations in Arizona. According to the Arizona Department of Health Services (ADHS), from 1990-2000 the average annual mortality rate from MVC per 100,000 population was 74.3 for American Indians compared to 19.4 for African Americans, 17.9 for White non-Hispanic, 20.1 for Hispanic and 13.5 for Asians. This trend continued in 2002; the MVC mortality rate was 68.6 compared to 20.4 per 100,000 population statewide.

RESEARCH OBJECTIVES

The project objectives are to assist three (3) of twenty-one (21) tribal governments to improve their abilities to:

- 1). Identify hazardous highway locations, sections and elements; and
- 2). Develop and prioritize projects.

EXPECTED IMPLEMENTATION

Most Tribes do not have the staff, training or financial capacity to establish and maintain a safety program. This research will provide Tribes the guidance to develop the technical requirements needed to build this capacity. The benefits to the transportation system will be a reduction in the number of MVCs and associated deaths, injuries and property damage on reservations. Additionally creation of data collection systems will provide the state data network a vital missing elements of traffic safety statistics.

Implementation would reduce estimated economic loss from MVC fatalities for fifteen tribes, which was from 1998-2002, \$575,240,000 with a total of 565 lives lost. The research would also support the federal Reauthorization legislation, which would increase safety funding for Arizona roads.

This project would assist Tribes abilities to access the FHWA national model for Tribes to compete for HES funds.

Traffic and Safety

STATUS OF RESEARCH

This project is anticipated to be completed by December 2007. A Funding Guide was completed on March 9, 2006. This document was made available to tribes not directly involved in the research.

TECHNICAL ADVISORY COMMITTEE (TAC)

Dale Buskirk - Champion	ADOT TPD
Reed Henry	ADOT Safety
Don Sneed	ADOT TPD
Richard Powers	ADOT Globe
Margaret Baha-Walker	White Mountain Apache Tribal Council
Grant Buma	Colorado Indian Tribes
Richard Fimbres	GOHS
Kenny Hicks	HIS Environmental Services
Felipe Sanchez	San Carlos Apache Tribe Planning Dept
Eleanor Strang	ADHS BMS
Don Williams	Tucson Area HIS Environmental Services
Jennifer Brown	FHWA
Karla Petty	FHWA
Bob Maxwell	BIA Branch of Roads
Todd Honyaoma	Hopi Tribal Council
Salsa Norstog	Navajo Nation DOT

Traffic and Safety

SPR-593, Development and Implementation of a Regional Safety Management Database

Research Agency:	Arizona State University	FY Authorization:	2005
Principal Investigator(s):	Dr. Simon Washington	Contract Date:	October 2004
Contract Amount:	\$122,000	Original Completion Date:	June 2005
Program Budget:	\$122,000	Estimated Completion Date:	September 2007
Expenditures to date:	\$116,170	Is project on schedule?	Yes
Available Amount:	\$5,830	ADVANTAGE No.	R059117P
Percent complete through 6/30/07	95%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

Uniform databases do not currently exist for local jurisdictions to conduct detailed safety investment studies, which severely inhibits them from applying for statewide hazard elimination funds and ultimately reducing motor vehicle related deaths, injuries, and property damage.

RESEARCH OBJECTIVES

The objective of this research is to assemble a regional crash database in the PAG metropolitan region compatible with the AZ Local Government Safety Project (LGSP) analysis model that supports safety analysis efforts for MPO and COG member agencies, and enables these agencies to apply for hazard elimination funds. The research will provide a uniform regional platform for safety evaluation and data management by conducting the following tasks: 1) Assess local jurisdiction safety databases; 2) Prepare a status report; 3) Develop a Regional Databases Development Plan and Manual

EXPECTED IMPLEMENTATION

Now is the time to develop a regional safety management database. Previous work by ADOT on the AZ LGPA Model and federal emphasis on “safety conscious planning” and consistent evaluation methodology provides a unique opportunity to implement a regional platform for safety evaluation and data management.

STATUS OF RESEARCH

This project is anticipated to be completed by September 2007.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

G Anderson	Oro Valley Dept. of Trans.
Jennifer Brown	FHWA
Paul Casertano	Pima Assoc. of Governments
Karen King	FHWA
Reed Henry	ADOT Traffic Group
Mike Hicks	Tucson Dept. of Transp.
Yousef Rad	Tucson Dept of Transp.
Kohinoor Kar	ADOT Traffic Group
Reza Karimvand	ADOT Tucson District
Scott Leska	Marana Dept of Transp.
Richard Nassi	Tucson Dept of Transp.
Bob Roggenthen	Pima County Dept. of Transp.
Nancy Ann Crandall	ADOT Traffic Records Section

Traffic and Safety

SPR-597, Highway Safety Incentive Report

Research Agency:	University of Arizona	FY Authorization:	2005
Principal Investigator(s):	Graduate Students	Contract Date:	3/28/05
Contract Amount:	\$18,750	Original Completion Date:	March, 2006
Program Budget:	\$18,750	Estimated Completion Date:	December 2007
Expenditures to date:	\$18,709	Is project on schedule?	Yes
Available Amount:	\$41	ADVANTAGE No.	R059717P
Percent complete through 6/30/07	95%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

Incentives are one of the strongest factors for influencing human action. Application of this factor to induce a greater effort to make roadways safer is worthy of testing.

The idea of setting up a pilot program to provide jurisdictions and/or agencies that have the opportunity to engage in efforts to make roadways safer, by saving lives is to stimulate creativity and experimentation with various initiatives and to reward those initiatives that produce positive results with financial inducements to keep up the good work. The competition for the financial rewards should encourage a more concerted effort to save lives. The rewards could induce less successful jurisdictions and agencies to adopt the methods that are proven successful elsewhere.

The net result should be a significant impact on roadway safety and the saving of dozens, if not hundreds, of lives each year from a more focused effort on behalf of safety by jurisdictions and agencies

RESEARCH OBJECTIVES

1. Supplement the fatality rate to growth developed through Phase I funding of the proposal by the Governors Office of Highway Safety.
2. Based on the fatality rates developed design an incentive program for reduction of fatalities measured against the baseline data.
3. Identify a method of for implementation of a pilot trial program for submission to FHWA nationally

EXPECTED IMPLEMENTATION

Establish an incentive program to encourage jurisdictions to create new ways to reduce projected fatality rates and receive rewards, recognition for doing so. Create a repository at the GOHS for programs that have proven results in preventing fatalities as documented by the success in each of the rewarded jurisdiction.

STATUS OF RESEARCH

This project is underway.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

Reed Henry Traffic Group
George Wendt Risk Management Section
Governor's Office of Highway Safety
MAG Safety Office
FHWA
City of Phoenix
City of Tucson
City of Tempe
City of Mesa
City of Glendale

Traffic and Safety

SPR-625, Safety Enhancements for Median Crossovers

Research Agency:	Pending	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	NA
Contract Amount:	Pending	Sched. Completion Date:	NA
Program Budget:	\$30,000	Est. Completion Date:	NA
Expenditures to date:	0	On schedule?	NA
Available Amount:	\$30,000	ADVANTAGE No.	R062519P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

ADOT workers and DPS officers face serious safety issues when work requires them to turn around on limited access highways. Rural corridors have few interchanges, so emergency use of designated safe crossovers is necessary. Many other flat median areas can be unsafe, due to soft soils or poor sight lines. ADOT has standards for marking approved crossovers for official vehicles, but which may be obscured in poor visibility conditions (fog, rain, snow, dust, smoke). Patrol officers, snowplow operators, fire crews or tow truck drivers who must slow down in the high-speed left lane to look for, or to turn into, the median crossover are all at great risk, as are the other highway users. A more reliable approach is needed to mark crossovers and to provide sufficient lead time to signal and safely slow down.

RESEARCH OBJECTIVES

This project will perform a state-of-the practice review of the most current on-board and on-site concepts to accurately locate approved crossovers in advance of the decision point. It would include a national Internet and literature search of current products and practices using winter maintenance industry and agency resources. Focus groups including other agencies and private parties would inform stakeholders on the safety issues and confirm their needs. The most practical, economical solutions for ADOT would be identified from current best practices and non-technical innovations ‘on the ground’ by others.

EXPECTED IMPLEMENTATION

Recommendations would be made for both technical and non-technical alternative solutions that are practical, low-cost, and effective for each of the primary regional visibility issues.

STATUS OF THE RESEARCH

The project is not yet underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Lonnie Hendrix	Central Maintenance, Champion/Sponsor
Districts	Statewide

Traffic and Safety

SPR-629, Analysis of Capacity and Operations after Retrofit Improvements of Happy Valley and I-17 Roundabout Traffic Interchange

Research Agency:	United Civil Group	FY Authorization:	2007
Principal Investigator(s):	Mike Simpson	Contract Date:	2/12/07
Contract Amount:	\$79,778	Sched. Completion Date:	November 2007
Program Budget:	\$80,000	Est. Completion Date:	November 2007
Expenditures to date:	\$7,978	On schedule?	Yes
Available Amount:	\$72,022	ADVANTAGE No.	R062919P
Percent complete through 6/30/07	10%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

This proposed study would assess the effectiveness of the improvements which mainly included retrofitting the single lane to a dual lane circulating roundabout, implemented in 2005.

RESEARCH OBJECTIVES

This proposed study would analyze the current operation and capacity of the roundabouts along with what improvements are necessary for improved operations if any. The objectives include the delivery of the following items:

- Current geometry and traffic flow conditions
- Analysis on the operation of the roundabouts
- Comprehensive accident analysis
- Comparison of before and after the conversion retrofit
- Analysis of the effectiveness of the current signing and marking and how it compares to national application
- Comparison of operation of similar roundabouts (handling about the same volume) within the nation
- Areas of improvements and cost of these improvements if any

The outcome of this research project will give a general understanding of the operation and capacity of a two lane roundabout in Arizona.

EXPECTED IMPLEMENTATION

Based on the findings of this study, modifications and improvements to future implementation of multilane roundabouts will be accomplished.

STATUS OF THE RESEARCH

The project is underway.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

Dan Lance	State Engineer's Office, Champion
Mike Manthey	Traffic Engineering, Sponsor
David Duffy	Traffic Engineering
Rados Gluscevic	Traffic Engineering
George Chin	Regional Traffic
Annette Riley	Valley Project Management
Victor Yang	Roadway Engineering
Nancy Ann Crandall	Traffic Records
Mike Cynecki	City of Phoenix
Kiran Guntupalli	MAG
Sharon Gordon	FHWA

Traffic and Safety

SPR-648, Crash Related Education, Enforcement, and Engineering Factors

Research Agency:	Pending	FY Authorization:	2008
Principal Investigator(s):	Pending	Contract Date:	NA
Contract Amount:	Pending	Sched. Completion Date:	NA
Program Budget:	\$120,000	Est. Completion Date:	NA
Expenditures to date:	0	On schedule?	NA
Available Amount:	\$120,000	ADVANTAGE No.	R064820P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

Crashes are the result of the coincidental occurrence of a combination of factors that exceed the drivers capability to maintain vehicle control. Identifying these contributing factors as education, enforcement, and engineering related would facilitate targeted remedial action.

In a typical lane departure crash an impaired driver exceeds a safe speed, the vehicle leaves the paved surface, the driver reacts by overcorrecting in an attempt to return to the paved surface, the vehicle overturns, occupants not restrained are ejected and perish. Targeting these factors with a combination of education, enforcement, and engineering efforts will provide engineers, law enforcement, and educators a better understanding of what is contributing to crashes and how to address them.

RESEARCH OBJECTIVES

Review fatal and serious injury crash reports to identify and categorize contributing factors such as overturn, type of vehicle, etc. and place in baskets similar to the Accident Location Identification Surveillance System (ALISS) database. Analyze and determine appropriate, effective education, enforcement, and engineering mitigation measures.

EXPECTED IMPLEMENTATION

Results that identify contributing factors and the associated effective enforcement, education, and engineering measures will be forwarded to the responsible agencies for incorporation into their ongoing programs.

STATUS OF THE RESEARCH

The project is not yet underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Reed Henry	Traffic HES, Champion/Sponsor
TBD	Communication & Community Partnerships
Jeff King	DPS
Michael Hegarty	Governor's Office of Highway Safety
TBD	Department of Health Services
Jennifer Brown	FHWA

Traffic and Safety

SPR-651, Using Substantive Instead of Nominal Safety During ADOT Project Development

Research Agency:	Pending	FY Authorization:	2008
Principal Investigator(s):	Pending	Contract Date:	NA
Contract Amount:	Pending	Sched. Completion Date:	NA
Program Budget:	\$50,000	Est. Completion Date:	NA
Expenditures to date:	0	On schedule?	NA
Available Amount:	\$50,000	ADVANTAGE No.	R065120P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

Rigid conformity to existing policies, standards and guidelines, does not guarantee safety for the traveling public utilizing the state highway system. ADOT standards for a highway posted at 65 mph indicate a clear zone distance of 30 feet from the edge of the travel lane on level terrain with 6:1 side slopes. Typically the right of way line may be found 30 feet or more past the clear zone boundary. Within the area found between the clear zone boundary and the right of way line, a myriad of hazardous fixed objects (trees, rocks, poles, electrical boxes, etc.) are frequently struck by errant vehicles that run off the pavement edge. Preliminary Traffic HES study results indicate that a majority of Run-Off-Road accidents occur at a distance of well over 30 feet from the pavement edge. As a result, it appears that wider clear zones need to be accommodated into the expansion of the clear zone distances that ADOT uses. In addition, there may be other standards, guidelines and “rules-of-thumb” that ADOT currently uses, which need some additional evaluation as well.

RESEARCH OBJECTIVES

Research each of the existing policies, standards, and guidelines that ADOT currently uses during project development to determine whether any low-cost safety enhancements could be incorporated into any existing standards, guidelines, procedures, or policies.

EXPECTED IMPLEMENTATION

Traffic Engineering working in conjunction with other ADOT organizations will lead the search for information, results, and implementation. Follow-up research is always plausible.

STATUS OF THE RESEARCH

The project is not yet underway.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

Reed Henry	Traffic HES, Champion
Mary Viparina	Roadway Engineering Group, Sponsor
Terry Otterness	Roadway Engineering Group
Jacob de Raadt	Roadway Engineering Group
Mike Marietti	Traffic Engineering
Tim Wolf	Phoenix Maintenance District
Cindy Eiserman	Risk Management
Jim Redpath	Attorney Generals Office
Karen King	FHWA
Jennifer Brown	FHWA

Traffic and Safety

SPR-652, Countermeasures to Reduce Big-Rig Crashes

Research Agency:	Pending	FY Authorization:	2008
Principal Investigator(s):	Pending	Contract Date:	NA
Contract Amount:	Pending	Sched. Completion Date:	NA
Program Budget:	\$100,000	Est. Completion Date:	NA
Expenditures to date:	0	On schedule?	NA
Available Amount:	\$100,000	ADVANTAGE No.	R065220P
Percent complete through 6/30/07	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

ADOT's Motor Vehicle Division reported that trucks (large and small) constitute 27% of vehicles involved in crashes and 30% of fatal crashes. Although big-rig crashes are less frequent than those involving passenger cars, their impact on fatality and traffic congestion are far greater than passenger car related crashes. Hence, countermeasures to reduce big-rig crashes are crucial from the safety and congestion management standpoint.

RESEARCH OBJECTIVES

The objectives of this research are to identify freeway segments in Arizona with high frequencies of big-rig crashes and to develop countermeasures to reduce the probability of incident occurrence.

EXPECTED IMPLEMENTATION

Findings and recommendations from this study are expected to be deployed on the identified hot spots.

STATUS OF THE RESEARCH

The project is not yet underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Reed Henry	Traffic HES, Champion
TBD	MVD Enforcement, Sponsor
Kohinoor Kar	Traffic HES
Scott Nodes	Technology Group
Cindy Eiserman	Risk Management
Sarath Joshua	MAG
Karen King	FHWA
TBD	Governor's Office of Highway Safety
TBD	Federal Motor Carrier Safety Administration

Research Support Programs

Research Support Programs

SPR NO.	BUDGET ITEM	TOTAL BUDGET
110	ATRC Library Resources	\$ 98,295

This budget item provides for the following services on an on-going basis:

Technical—Requests and receives new publications from federal, state, and private sources, classifies and catalogs new materials, maintains the library computer databases, maintains circulation records.

Service—Provides complete research assistance, including customized bibliographies from computer databases for Arizona Department of Transportation (ADOT) staff upon request, distributes library materials to ADOT staff, provides photocopies of articles upon request, provides interlibrary loans of books.

Public Awareness—Monitors the printing and distribution of all Arizona Transportation Research Center (ATRC) publications, coordinates the efforts taken to increase public awareness of ATRC, provides brief library presentations to ADOT staff upon request, maintains the ATRC Internet and Intranet sites.

111	AASHTO and Transportation Research Board Correlation Service	\$ 143,620
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This budget item is established to enable ADOT to participate in research studies initiated by the American Association of State Highway and Transportation Officials (AASHTO), implement the results of AASHTO work, and to support the annual subscription to the Transportation Research Board (TRB) Correlation Service. Dues for participation in AASHTO's National Transportation Product Evaluation Program (NTPEP) are provided by this item.

Research Support Programs

SPR NO.	BUDGET ITEM	TOTAL BUDGET
112	Administration of Research The budget for Administration of Research is based on the prior year's expenditures and the planned projection of activities for Fiscal Year 2002. The ATRC is responsible for initiation, technical review, coordination, and implementation of the research activities of ADOT. Other participating charges made to Administration are out-of-state travel expenses to national/regional conferences, short courses or seminars. Other administrative costs are computer use, in-state travel, and office supplies. Research personnel are responsible for the publication of many reports derived from these activities. Payroll expenditures for secretarial service and typing are charged as overhead costs of operation of the ATRC, as well as graphic artwork and printing. This budget item also provides for state services rendered in support of the SPR program. Examples include, but are not limited to, engineering consultant services and external/internal audits. Other costs include miscellaneous services, employee-related expenses, and membership in or support for professional organizations such as ITS America.	\$ 146,689
113	Support Staff Salaries This budget item is established to provide the funding for additional staff support for the ATRC. The additional staff provides the expertise to manage and conduct research identified in the State Planning and Research (SPR) Program.	\$ 375,068
114	Technical Editing This budget item provides funds for technical editing services for review and editing ATRC reports and documents.	\$ 52,350
116	Product Resource Investment Deployment and Evaluation (PRIDE) The PRIDE program coordinates the review and acceptance of new products for possible use by ADOT and maintains the Approved Products List (APL). The ATRC PRIDE program administrator coordinates the program with two Product Evaluation Committees: Materials, and Traffic Control.	\$ 238,180
117	Local Technical Assistance Program (LTAP) This budget item is to identify the State's portion of the LTAP undertaking for this fiscal year. Annual renewal is subject to co-sponsorship by the Federal Highway Administration (FHWA).	\$ 123,716

Research Support Programs

SPR NO.	BUDGET ITEM	TOTAL BUDGET
118	Transportation Research Quick Study (TRQS) Program This budget item provides funds for specific research topic support. TRQS studies are limited to budgets of \$5,000 or less.	\$ 40,000
120	Pooled Fund Studies (FY 2005) This budget item is established to enable ADOT to participate in both national and regional Pooled Fund Studies. A listing of these projects may be found in the Pooled Fund Programs section of this document.	\$ 50,000
124	Research Traffic Data Collection This ongoing project supports traffic data collection and monitoring for the Long Term Pavement Performance (LTPP) program. Arizona is an active participant in the LTPP program. Under this program, ADOT constructed 111 test sections in support of the Specific Pavement Studies (SPS), 25 test sections in support of the General Pavement Studies (GPS), and 52 test sections in support of innovative materials research under the LTPP program. Vital to the successful outcome of this research is the simultaneous monitoring of traffic characteristics at these test sections. Resources under this project are employed towards the establishment of data collection sites (AVC: Automatic Vehicle Classification and WIM: high speed Weigh-In-Motion), and site operation, maintenance, calibration, data evaluation, and data management.	\$ 297,765
125	NCHRP The National Cooperative Highway Research Program (NCHRP) is an applied, contract research program that develops near-term, practical solutions to problems facing transportation agencies.	\$ 740,000
127	Small Budget Studies Since 1997, 28 small budget projects have been completed by the Arizona Transportation Research Center (ATRC). The Research Steering Committee has authorized an annual allotment of \$200,000 specifically designated for small budget projects (\$25,000 or less). These projects may be undertaken at any time during the year.	\$ 276,000
999	Special Projects/Contingency This item is included to enhance Research Program management and will be used to fund change orders in on-going research studies and initiate new studies developed during the program year.	\$ 800,019

Pooled Fund Projects

Pooled Fund Projects

Project No.	National Studies	Obligated Amount	Project Manager
SPR-2(207)	Transportation Management Center (TMC) Study	(1)	Steve Owen
SPR-3(020)	ENTERPRISE	\$292,743	Steve Owen
SPR-3(072)	Internal Stability Design of MSE Walls	\$10,000	Christ Dimitroplos
SPR-3(077)	Wiremesh and Cable Mesh Slope Protection	\$5,000	Tom Kombe
TPF-5(004)	Long Term Pavement Performance (LTPP) Specific Pavements Study (SPS) Traffic Data Collection	\$300,000	Tom Kombe
TPF-5(017)	WASHTO-X Technology Transfer Initiative	\$20,000	Frank Darmiento
TPF-5(036)	Maintenance Quality Assurance Peer Exchange	\$5,000	Jason Harris
TPF-5(037)	Southeast Superpave Center	\$105,055	Christ Dimitroplos
TPF-5(085)	Transportation Security Plan	\$50,000 (2)	Lonnie Hendrix
TPF-5(099)	Evaluation of Low Cost Safety Improvements	(3)	Jason Harris
TPF-5(125)	US-Mexico Joint Working Committee (JWC) Pooled Fund Study	\$65,594	Dale Buskirk
TPF-5(145)	Western Maintenance Partnership	\$10,000	Lonnie Hendrix
TPF-5(166)	Application of Three-Dimensional Laser Scanning for the Identification, Evaluation, and Management of Unstable Highway Slopes	\$30,000	Frank Darmiento

(1) \$100,000 provided by the Transportation Planning Division

(2) \$25,000 additional funds

(3) \$90,000 from Hazard Elimination and Safety funding

For additional information on these pooled fund projects see the Internet at:

www.pooledfund.org

Research Publications Catalogue

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AZ-123	Testing for Debonding of Asphalt from Aggregates. Jimenez, R.A. April 1973.
AZ-124	Final report - Phase 1: Structural design of Asphalt Pavements (Arizona). Jimenez, R.A. Oct 1972.
AZ-141-1	Soil Erosion and Dust Control on Arizona Highways Interim Final Report: Part 1: State of the Art Review. Sultan, Hassan A. Oct 1974.
AZ-141-2	Soil Erosion and Dust Control on Arizona Highways Interim Final Report, Part 2: Laboratory Testing Program. Sultan, Hassan A. Oct 1974.
AZ-141-3	Soil Erosion and Dust Control on Arizona Highways Progress Report, Part 3: Field Testing Program. Sultan, Hassan A. Nov 1974.
AZ-141-4	Soil Erosion and Dust Control on Arizona Highways Final Report: Field Testing Program. Sultan, Hassan A. Feb 1976.
AZ-144	Polymer Pavement Concrete for Arizona, Study 1. Popovics, Sandor. Nov. 1974
AZ-145	Field Stabilization of Chinle Clay By Electro-Osmosis and Base Exchange of Ions. Mancini, Frank P.; O'Bannon, Charles E. Oct 1975.
AZ-146	Frictional Properties of Highway Surfaces. Burns, John C. Aug 1975.
AZ-149	Field and Laboratory Evaluation of Debonding Test Procedures. Scott, Noel R.; Ritter, John B. March 1980.
AZ-150	Final Report; Phase 1 Asphalt Emulsion Treated Aggregates – Part 1: Laboratory Evaluation. Jimenez, R.A. June 1976.
AZ-151	Final Report: Methods and Parameters for the Use of Emulsified Asphalts for Prime Coats and Binders for Open-Graded Asphaltic Concrete Finishing Courses. Smith, Boyd; Nelson, Richard H. 1974
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AZ-155	Development of a Network Optimization System: Appendixes. Kulkarni, R.; Golabi, K.; Finn, F.; Alviti, E. Aug 1980
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AZ-157	Environmental Factor Determination from In-Place Temperature and Moisture Measurements under Arizona Pavements. Way, George B. Aug 1980.
AZ-158-1	Utilization of Waste Boiler Ash in Highway Construction in Arizona – Part 1: Portland Cement Concrete. Rosner, John C.; Hamm, M. Kent. Dec 1976.
AZ-161	Development of Framework for a Pavement Management System for Arizona. Finn, F.N.; Kulkarni, R.; Mcmorran, J. Aug 1976.

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- AZ-164 Final Report – Phase 1: Testing Methods for Asphalt Rubber. Jimenez, R.A. Jan 1978.
- AZ-167 Laboratory and Field Development of Asphalt Rubber for Use as a Waterproof Membrane. Frobel, R.K.; Jimenez, R.A.; Cluff, C.B. May 1977.
- AZ-174 Optical Sieve Comparator Development Project. Poluianov, G.; Mancini, F.P. June 1979.
- AZ-175 Field and Laboratory Evaluation of Sulfur Asphalt Patching Materials. McCullagh, Frank R. Aug 1982.
- AZ-176 Sulfur-Asphalt and Aggregate Mixtures. Jimenez, R.A.; Meier, W.R. June 1981.
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- AZ-179 Arizona's Salt Gradient Solar Pond. Hauskins, John B., Jr.; Mancini, Frank; Kolaja, Rudolf Oct 1987.
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- AZ-182 Overlay Deflection Design Method for Arizona. Eisenberg, John F.; Way, George B.; Delton, James P.; Lawson, John E. March 1983.
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- AZ-192 Left Turn Signal Warrants for Arizona. Matthias, J.S.; Upchurch, J.E. May 1985.
- AZ-195-1 Vehicle Classification Procedure Study. Matthias, J.S.; Dean, A.G. June 1984.
- AZ-196 Visual Processing and Driving Safety. Lindholm, Julie Mapes; Young, H. Hewitt; Radwan, A. Essam Nov 1986.
- AZ-197 The Technical Feasibility, Socioeconomic Impact and Environmental Benefits of Alternate Energy Vehicles in the State of Arizona. Saczalski, Ken; Mullens, Lanny; Schnorr, Janet; Morgan, James. Aug 1986.
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AZ-201	Development of Data Measurement Techniques for Traffic Operations Analysis at Intersections. Wortman, Robert H.; Fox, Thomas C. June 1985.
AZ-202-1	Small Sign Support Analysis Phase 1: Crash Test Program. Ross, Hayes E., Jr.; Sicking, Dean L.; Campise, Wanda L.; Zimmer, Richard A. Aug 1988.
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AZ-205-2	Information Systems in ADOT: An Analysis of Intra-Function Flow, Decision Support Needs, Existing Systems Utility and User Attitudes Vol. 2: Manual for Evaluation of Needs and Attitudes of EDP Users. Moor, W.C.; Bailey, J.E.; Evans, P.A.; Roberts, A. March 1985.
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- AZ-209-2 Comparative Assessment of Computer Programs for Traffic Signal Planning, Design and Operations – Vol. 2: Software Descriptions. Radwan, A.E.; Sadegh, A.; Matthias, J.S.; Rajan, S.D. Dec 1986.
- AZ-209-3 Comparative Assessment of Computer Programs for Traffic Signal Planning, Design and Operations – Vol. 3: Recommended Software Output. Radwan, A.E.; Sadegh, A.; Matthias, J.S.; Rajan, S.D. Dec 1986.
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- AZ-226-1 Phoenix Metropolitan Area External Trips Study – Vol. 1: Final Report. Barton-Aschman Assoc., Inc. Dec 1986.
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